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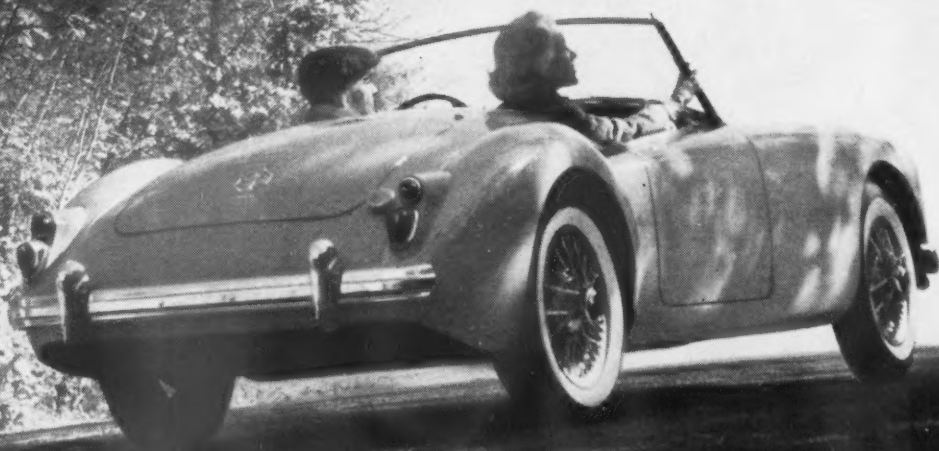


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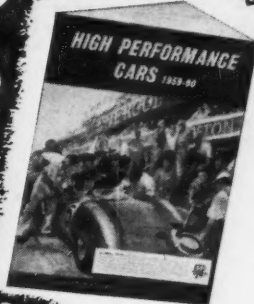
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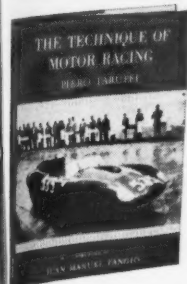


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The spanking-new Lotus Seven America on this month's cover was photographed for SCI by William Bradley.



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OBSERVATION AND OPINION

MANY FORWARD STEPS—Several moves are being made this month to make SCI a better magazine and — especially — to make it more useful to you. Most importantly we have a new printer, who'll be producing this prose by letterpress instead of the offset system SCI has used since its birth. This means we'll have a crisper-looking, more precise publication that'll provide a more fitting background for the fine machinery that's to be found in the auto world these days. Once we've settled into our new routine, it also means that we'll be able to bring you more timely coverage of topical events like races and new-car introductions. You'll benefit directly, too, from a speedier response to your classified ad in SCI.

The letterpress system's quicker reflexes have also allowed us to advance SCI's "on-sale" date, to bring the magazine to you earlier each month. Unfortunately this makes the actual date of each issue even more unrealistic than it's been in the past, with the result that you may be buying this June issue while April is still a very recent memory. We're no happier about this advance dating than you're likely to be; it's just one of the unfortunate byproducts of the structure of magazine distribution. What counts is what is in each issue of SCI and when it arrives in your mail slot or news-stand. We've done our best to improve both.

HORSE BEFORE THE CART—SCI's Mike Davis has been among the first Detroit observers to ferret out and confirm the hottest rumor from the Motor City: the imminent arrival of front-wheel drive.

In conjunction with the Panhard road test in this issue, Steve Wilder analyzes front-drive in its modern guise — bringing out many of the design considerations that make the layout so attractive to product planners in Detroit. This review is backed up by a Road Research Report on the very best front-wheel-drive car that SCI has ever driven: the Austin 850. This little automobile is so satisfying and delivers so much fun per cubic foot that it makes you wonder why cars have to be any bigger.

Also in the Panhard story, our Road Test Editor clarifies the purpose and practice of our RRR's unique Steering Behavior test, explaining in full how to interpret these graphs and how you can set up a similar test of your own.

HISTORY OF A SPORTS CAR—On page 68 *et seq.* there are some remarks about one of the greatest sports cars of all time. In original form they constitute one chapter in a book called **MERCEDES-BENZ GUIDE**, one segment in the Modern Sports Car Series published by Sports Car Press, in New York. Freely and without contrition I would like to urge everybody to buy this book, for reasons which will be evident when you see who wrote it.

FORMULA SENIOR!—Just back from Italy, Martin Biener of Biener Imported Cars reports booming interest overseas in the idea of a Formula Senior, either as a separate entity or a replacement for the present Formula 2. SCI's presentation of Count Lurani's views on this exciting formula, in the March, 1960 issue, has elicited substantial interest and response in this country that deserves attention from our representatives to the F.I.A. Whether or not it's possible to make any significant impression on this august body, however, seems debatable. At their Monte Carlo conclave, back at rally time, the F.I.A.'s International Sports Commission (C.S.I.) indicated a desire to keep the existing Formula 2 in effect for a few more years. This would produce the laughable situation of Formula 2 cars that were lighter than the concurrent Formula 1 machines and fully as powerful, since they'd both be pegged at 1½ liters! The C.S.I. is apparently also interested in retaining the present 2½-liter Formula as a *Formule Corse* — a move which we fail to comprehend. In fact their whole approach reflects an inability either to put an end to existing rules or to create new ones. Of course the C.S.I. is not an entity of itself but is composed of representatives from member countries of the F.I.A., and we have a very real voice (theoretically) through our representatives. If you're interested in a Senior-type Formula 2, with a limit of 2½ liters for Grand-Touring-class engine and perhaps a minimum weight in the 1500-pound bracket — as a builder, driver or just an enthusiastic spectator — the man to contact is Charles Moran, Jr., Automobile Competition Committee of the United States, 515 Madison Avenue, New York 22, New York. If any results can be obtained, that's the way to obtain them.

Karl E. Ludvigsen

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LETTERS

RACE RESULTS

Being a subscriber and fan of your magazine and follower of racing events, I have a question regarding an article in March's issue.

Page 89 lists in order of finishers the drivers in the First Grand Prize of the United States. However, their times do not coincide necessarily with their corresponding position. Please explain. This has always been a constant source of bewilderment.

Stanley Plotkin
Brooklyn, N. Y.

That you were confused is understandable. There were errors both of omission and commission in our tabled results. Tony Brooks's time was wrongly printed, and should have been 2:15:36.6. Considering this, the times as given do make sense for the first four finishers, who were on the same lap. But Innes Ireland, whose time seems to be sandwiched between those of Trintignant and Brooks, was actually on his 39th lap when the flag fell—against 42 laps for the first four. Places 6 and 7 should be credited with only 38 laps.

FORMULA 1 PROPOSAL

Thank you for the excellent feature on the 1961 Formula. Both Moss and von Frankenberg have very good points in favor of their arguments. However, I feel that the 1961 Formula argument will not be resolved until 1962 or '63 or '64. In the meantime, I have a question: what do you suppose will be the Formula for 1965? Or 1970? On the order of 350-400 cc unblown, don't you think?

Perhaps when I graduate to Formula Jr., I should put my Go-Kart in cosmoline. Who knows—it may very well be the Formula 1 car of 1975! In fact with that many years' experience in putt-putt machinery I might even be the first white-haired Formula 1 World Champion!

Seriously, I've given more than a passing thought to this whole Formula 1 business and I seem to return to the idea of a Formula based on production engines running on straight gasoline. You might attach dimensions of something like five liters unblown and two liters blown, or allow varying degrees of modifications, such as "nothing you can see from the outside, but anything goes inside," but stick with the basically stock idea.

After all, if we can have 400-plus-bhp monsters running on the highways, why not on the race track? Certainly they'd be safer in the hands of competent chauffeurs than in the hands of the idiots we allow on the highways.

But I suppose this Formula-reducing mania will proceed unchecked so perhaps I'd better go back to fooling with my old Class C model airplane engine. (15 cc, 12,000 rpm 1/4 bhp.)

David A. Wood
New York, N. Y.

MORE ON THE ASARDO

With reference to the letter on the Asardo published in your January 1960 issue we wish to add a few corrections.

The technique of using green pigment in one of the layers initially sprayed, was only used during the construction of the master mold, in order to guide us when sanding. This is not necessary when casting the actual body panels, which, however, do need sanding. Even the parts lifted from the matching dies in the Chevrolet-Corvette plant in Astabula are sanded. This is important for the final finish and for the further preparation for paint. In the body panels pigment was used also, but not for sanding purposes. It served mainly to filter out sunlight which can penetrate the plastic otherwise. This pigment was not mixed with a clear polyester resin but with the Gel-Kote used as initial layer on all body panels. This Gel-Kote is thinned by means of mixing it with Acetone, this thinner can not be used with the other polyester resin used with the reinforcement glass. Styrene was only used in very small quantities where the resin proved to be too thick and unworkable. This happens sometimes and when using resins of different manufacture. It should be avoided as much as possible for the reasons the writer already explained in his letter to you. I forgot to mention that the reason for thinning the Gel-Kote is, of course, because it is sprayed and therefore must be thin.

We have no trouble whatsoever with our female master mold, and presume that the reinforcement technique used was a successful one. Individual body production molds are, however, constructed in a different manner.

We are also happy to add, that the first series of 25 Asardo cars will be available in the U. S. sometime during the summer and that a production of 25 cars per month will soon be possible.

H. W. Schlosser
Asardo Co., Inc.
Fort Lee, N. J.

MILLER RESTORATION

I must say thanks to Griff Borgeson, Sports Cars Illustrated, Ziff-Davis Publishing Company and all the others responsible for bringing the front-wheel drive Millers back to the U.S.

These ex-Duray, ex-Bugatti cars have been justly renamed the Sports Cars Illustrated Specials.

Donald Davis
W. Lafayette, Ind.

Project Time Machine (SCI, January, 1960) is very much the personal project of Griff Borgeson, but SCI and Ziff-Davis take pride in their contribution to this very exciting cause. You and other readers who have been fired by this dream effort will be glad to hear that Griff is proceeding apace with restoration of the cars, and that he will present a complete technical report—with LaTourette cutaway—in the July SCI. We would like to apologize to Griff and to our readers, in the meantime, for the inadvertent juxtaposition of a portion of his fine "Run for the Mileage" article in the April SCI. It was our fault, not his.



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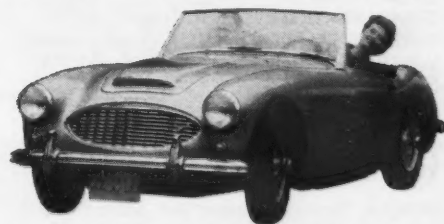


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INQUIRIES: If your car is not listed above, airmail us a full description and we will quote by return airmail.

EUROPEAN NEWSLETTER

NEW GORDON AND ALFA

Making its debut at the Geneva show was the Gordon, the Chevrolet-powered G.T. four-place coupe that SCI discussed last month. On paper and in the flesh, the Gordon is exciting. Dash layout is similar to that of Facel Vega, with a neat cluster of instruments and toggle switches set in a sexy between-the-seat console.

Alfa-Romeo had a surprise at Geneva in the form of a two-place extra-light Sprint Speciale executed by Zagato. Overall length is a bit shorter than the normal Giulietta and it's powered by the "Speciale" engine.



Weight is said to be 1650 pounds including oil, water and fuel. No price was available at Geneva, and it's probable that the new car will undergo further modifications before reaching the market. There's still no word about the much-rumored 1.6-liter Alfa.

PREMATURE PROTOTYPES

Absent at the 1960 Geneva Automobile Show was the new 404 Peugeot, to be announced soon. Styling is again by Pinin Farina (the 403 was a Farina design) and was executed almost five years ago. 85 horsepower for a 1600 cc touring version will give the new French car remarkable performance. As was the case with the new front-wheel drive four-cylinder Lancia currently under test, the 404 was prematurely "announced" in Paris's L'AUTO JOURNAL, a twice-monthly automotive paper that all manufacturers hate but yet read religiously (usually with magnifying glass in hand for closer inspection of the grainy and sometimes blurred photographs of competitors' prototypes).

GENEVA TRIALS

Available for first-time-anywhere trials at Geneva were the Facellia and the Abarth-Fiat 2200 coupe with Allemano body. The 1.6-liter Facel car (SCI, April, 1960) is still in the very early stages of production and it will be at least six months before it's fully developed and available in any quantity. Its performance is comparable to the Porsche Super 90 and it has good road-holding as well as a smooth ride. The engine seems to be noisy at high speeds, however. Beautifully appointed and with

a dashboard layout that is particularly functional, the Facellia is certain to be a seller.

The best way to describe the Abarth-Fiat 2200 by Allemano is to dub it an attempt by Abarth to build a small Ferrari, for that's exactly the way the machine acts and sounds. It does not, of course, have the tremendous "punch" that the 3-liter Ferrari possesses. Nevertheless, the new Abarth goes well. We saw 125 mph on the speedo at which point we stood on the Dunlop disc brakes. Deceleration was rapid and even — impressively so. The two-liter Fiat engine has been markedly improved by, among other things, the addition of three Weber carburetors and it is hoped that SCI will be able to explore the Abarth modifications more completely at a later date. The car is luxuriously finished in leather with comfortable reclining seats. The dashboard and instrument layout is as legible and functional as one can find anywhere.

Bertone's body on the Gordon tube frame comes close to an ideal: the four-seater sports car.



PORSCHE SKILL SCHOOL

A possible answer to those calling for increased speed limits in Europe is the driver-training program about to be initiated by the Porsche company. The first "Anti-skid School" was organized at Zandvoort, Holland by Rob Slotemaker and the idea has now spread to England. We spent a day at the school in England sliding about in ancient Ford V8 Pilot sedans on a wet slippery piece of highway under the eye of a skilled instructor. American military authorities in Europe are concerned over the large number of road accidents currently occurring, and Porsche hopes to start a program that will teach people how to control a car in an emergency. The sports car clubs at each base will be asked to cooperate as will the Military Police. Statistics have shown that enforcing a 60

(Continued on page 12)

ITALIANS BUILD SUCH EXCITING CARS

Alfa Romeo



DISCRIMINATING owners and competition drivers everywhere testify there's nothing to compare with Alfa Romeo performance and pride of ownership. For, built into every Alfa Romeo is the flair for great design and the technical superiority born of Italian passion for flawless craftsmanship that has been proved by countless victories on road and track. Plan now to see and test drive any of the great Alfa Romeos to experience the rocket acceleration, the silent power, the effortless handling and great roadability that will make this your proudest personal possession.

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1300 cc, 91 hp, 96 mph	
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MG MITTEN IS RACE HEADQUARTERS

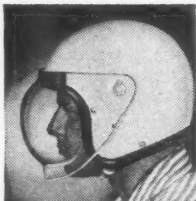
says

Marion Weber

Hi, There! We have been catering to the go fast group for like seven or eight years now and many of the world's best known drivers order from MG Mitten or come in person to our showrooms and select the necessary adjuncts to sports car racing. Listing these celebrities might impress you but it's a better bet that you would be impressed by the completeness of the selection in our stock. Take goggles. Here are four different styles:

BELL 500 TX HELMET
gives full coverage.
Approved for racing
\$37.00

FLIP UP BUBBLE SHIELD—clear—\$7.95.
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PROTECTOR GOGGLES
(Buttafari)—Have laminated shatterproof lenses, soft rubber face pad. Clear or tinted lenses, adjustable nose piece, anti-fogging vents.\$14.95
Non-adjustable .. \$1.95

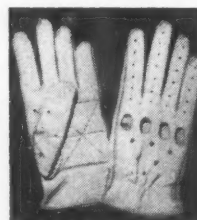


MONACO GOGGLES have molded rubber frame, interchangeable plastic lenses (Non breakable, naturally) big field of vision and face-contoured shape (clear amber or green lenses) \$2.95 pr.

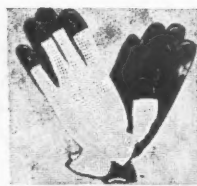
Spare lenses for above60c

COVERALL BARGAINS

Les Leston model, flameproofed light poplin, comfortable. Sizes 34-46—Regular \$22.95....\$17.95
Lion brand, very popular.
Sizes 34-46—Regular \$15.95\$13.95
Not all colors in all sizes, so give two or three choices.



GRAND PRIX GLOVES
Stand up under the abuse of competition. Double palm, gathered wrist, vented back, natural or black.
Sizes 6½-10 ..\$7.95 pr.



LES LESTON GLOVES have cape palm, knit back, light and cool. Gathered wrist and inset thumb for comfort.
Sizes 7-10, natural color. \$6.50 pr.

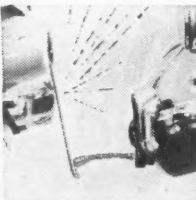
LUGGAGE RACKS at money-saving prices

Your choice of all-steel chrome plated, detachable or permanent racks for MGA, TR, Healey\$19.95
Wood and chrome, (detachable) for above cars\$19.95
You would expect to pay far more for these fine racks. Buy now before vacation. OCTOPUS BAGGAGE STRAP (eliminates rope)\$ 2.95



Racing driver's carry all cleverly contains all equipment essential to a good race weekend except a car (oh, all right, and a girl). Outside of these inconsequential details, this 16" by 14" soft bag (that slips under an airplane seat) keeps in one place the helmet, goggles, or shield, shoes, coveralls, stopwatch, camera, etc. that you want to have at hand. Waterproof nylon exterior, softly lined for no-scratch. Includes separate flannel bag for goggles. You can't find anything like it because we originated it for a few friends. Get one now.

CARRY ALL\$12.95



Sonie Shield: Can't be used in racing but a wonderful investment for parking protection. Two wires to connect, sounds horn when touched by careless parker ahead (or behind if you install it that way). Saves dents.
\$9.95



STRAW HAT, for watching the races in, is a glamorous headpiece. Deep dish brim flatters the face. Natural straw with red or aqua streamers (for security) beige with coffee, black with white\$3.95



Get a new car lately? If so protect your investment by protecting its appearance. Keep it covered with a Mitten if it sits outside as little as four hours a day. Easy on and off, stays snug. Does a money-making job. Ask for details on cars not listed.

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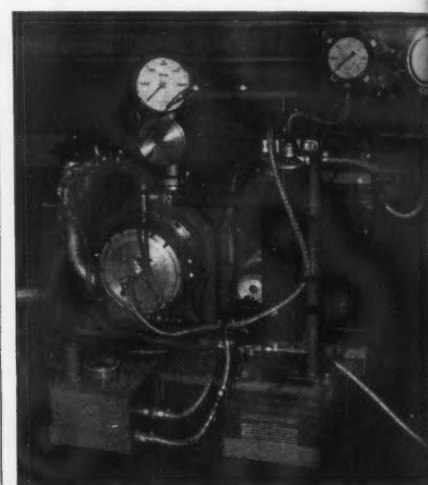
Due to increased postal rates we must ask you to add 5% to the total order to help pay postage. We have resisted raising prices for several years but the last postage hike got to us. Calif. residents should also add 4% state sales tax.
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(Continued from page 10)

mph speed limit on certain sections of German Autobahn has done nothing but raise the fatality rates. Obviously the only answer is to improve the skill of each driver and there has been a notable improvement, at least in Germany, on the part of the average man behind the wheel. They seem to become more aware of the traffic around them—a condition that just didn't exist a few years ago. The observant, skilled driver is still a rarity, however.

NSU-WANKEL IN ACTION

Research and development work on the NSU-Curtiss-Wright-Wankel engine continues here in Europe both at Neckarsulm, where NSU is located, and at Dr. Wankel's home in Lindau, Germany. We visited NSU recently, and were shown the experimental shop where these rotary engines are assembled and test-run. Two test beds are presently in use, and a water brake will be installed shortly.



It was impressive and exciting enough to see parts of numerous Wankel engines lying about on the work benches in the hands of a selected group of mechanics assembling and disassembling them, but even more interesting was the actual demonstration run of a rotary engine on the test bed. One of Dr. Froede's assistants escorted us into the test room and asked a mechanic to fire up a freshly-assembled unit. The mess of pipes and hoses in front of us looked like a piece of heavy-duty refrigeration equipment, but here was a Wankel engine actually running before our eyes. As the coolant temperature rose, the throttle was opened and the tachometer began to climb. Four—five—six thousand rpm and we touched the engine casing. The complete absence of any vibration was astonishing. Several of NSU's Primas have been fitted with Wankel engines for the company directors to play with, but it will be some time before the revolutionary new powerplant will be on the market. Aviation may be the first field to feel the influence of the new engine under the direction of Curtiss-Wright engineers. Most interesting of all is the fact that Daimler-Benz is extremely interested in Mr. Wankel's powerplant and has dispatched a team of technicians to study it. (Ed.—A complete technical report on the Wankel engine with cutaway, will appear in SCI next month.)



NEW BRITISH TRIUMPH: The car that almost never needs greasing!

It's the TRIUMPH/Herald—3 full engineering years ahead of all other economy cars—domestic or imported. Researched and tested the world over to meet world-wide driving needs. Worth seeing and driving before you buy any car.

Only 4 parts of the TRIUMPH/Herald ever need grease: the trunions and water pump once every 6,000 miles; the steering box and wheel bearings once every 12,000 miles. (That's about *once a year*, if you drive as much as most people.)

This is just *one* of the TRIUMPH/Herald's many innovations. It is a result of a TRIUMPH factory team's two year survey in 87 countries of world-wide driving needs...for the present and future. Here are some more startling advances that put the TRIUMPH/Herald 3 full engineering years ahead...

4-wheel independent suspension plus a torsion bar

Whatever the road surface, the TRIUMPH/Herald stays absolutely level, thanks to its 4-wheel independent suspension stabilized by a torsion bar. It is all but impossible to make the TRIUMPH pitch, roll or turn over.

The TRIUMPH is incredibly nimble. It turns around in only 25 feet...parks with only 18 inches leeway. Another sure sign of TRIUMPH's advanced engineering is its quiet ride—despite its surprising power. The Sedan cruises all day at 65...goes over 70 with ease. The Sports Coupe and Convertible are the only economy cars with dual carburetion and they go over 80 m.p.h.... give up to 40 m.p.g.

Lower British insurance rates

The TRIUMPH/Herald sets a new standard for safety. It has 93% visibility... over-sized brakes...a steering column that telescopes in case of emergency...

solid Sheffield steel body...three layers of bumper up front and many other built-in safety features. As soon as the TRIUMPH/Herald was introduced, a major British insurance firm lowered its rates 12½% below the standard charge.

New low in repair costs

Unlike cars built as one unwieldy mass, the new TRIUMPH/Herald can be repaired quickly and cheaply. For the TRIUMPH people have built the body a new and better way—with 7 major sections. Now a damaged section can be removed, restored and replaced in no time flat.

While it is rarely necessary, the TRIUMPH/Herald is remarkably easy to service. 700 dealers in all 50 states carry a complete inventory of parts and give service.

Dramatically stylish—Unusually comfortable

The TRIUMPH/Herald is *literally* "streamlined"—with only 10 curves in the entire design. It was styled by the young Italian genius, Michelotti.

Driver comfort in the new TRIUMPH is unequalled among economy cars. The

seats, foam rubber down to the webbing, adjust to 72 different positions. Even the steering wheel is adjustable.

The TRIUMPH/Herald is lavish with space...more hip room than in most economy cars...more head room than in the largest American car. All three models have 13 cubic feet of clear trunk area—uncluttered by a spare tire. The luggage capacity of the Sedan is more than doubled by simply folding down the rear seat.

\$300 saving included in the list price

Each TRIUMPH/Herald costs several hundred dollars less than the average American car. Yet the *list* price includes the heater-defroster, molded "wall-to-wall" carpeting, foam rubber seats, washable vinyl upholstery, windshield washers, directional signals, twin sun visors, folding rear seat (Sedan)... everything but a radio and white wall tires. All these items, a \$300 value, are extras on other cars. But they are standard equipment on the TRIUMPH/Herald because they are considered "musts" for safe, comfortable driving.

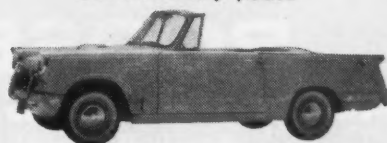
How to get a demonstration

Phone your nearest TRIUMPH dealer. He'll arrange a test drive right from your driveway—with no obligation, of course. Discover for yourself why the TRIUMPH/Herald is 3 full engineering years ahead of all other economy cars.

Sports Coupe only \$2149*



Convertible only \$2229*



TRIUMPH

HERALD

Sedan only \$1999*



*At U.S. Ports of Entry, plus state and/or local taxes. Slightly higher in West. White wall tires extra. Standard-Triumph Motor Co., Inc., Dept. FS-60, 1745 B'way, N.Y. 19, N.Y.

PIPELINE

NEED A CONNECTION?

Jano battery terminals will prevent many a bleeding knuckle when it comes time to switch batteries. Of plastic and metal construction, the Jano unit consists of four separate parts from top to bottom: knob, thimble, spider, and oil cup. When these are all fitted together and the cup filled with oil, corrosion is almost impossible. At the same time the Jano insures the best electrical connection possible. Send check or money order for \$3.95 for one set of terminals to Terminals, Dept. SCI, 22700 Martha Street, Woodland Hills, Calif.

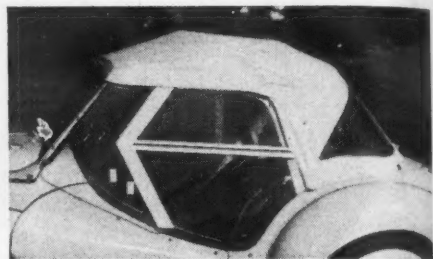
NEW COURSE

The Louisiana Hilltop Raceway has scheduled its first race—a Southwest Louisiana Region SCCA do—for June 5th.

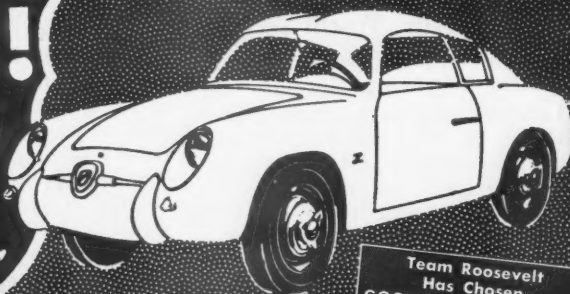
This new circuit is situated 13 miles east of Shreveport, La., on U.S. 80. Width of the track is 40 feet on turns and 25 feet



on the straights. Twelve turns and a 3200 foot straightaway carry the course through two wooded areas and around a small lake. Two of the 12 turns are banked. Overall length is just over two miles. Sounds like fun. The man to write for full details is Walter E. Hull, European Autos, 925 Murray Street, Alexandria, La.



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Team Roosevelt
Has Chosen
GOODYEAR Racing Tires
For The 1960 Season!

ONLY \$2895*

Derived from the 1959 SCCA class I production champion Fiat Abarth 750 car . . . the first low-priced, high performance true Grand Touring sports car is now available in the United States. With the well known Zagato coupe body, Carlo Abarth has incorporated a 33 brake horsepower single cam, 750 cc engine, remarkable acceleration, over 40 miles to a gallon of gas, interior appointments and passenger comfort of a true Grand Touring sports car champion. In 1959, a car similar to this competed in 12 SCCA National events. The total cost of replacement parts for this car amounted to \$130.47 (retail prices including 4 tires). For further information on other Fiat Abarth sports or racing models, write to . . .

ROOSEVELT Automobile Company, Inc.

Principal Fiat-Abarth Distributor,
Fiat Distributor Southeastern United States
2825 V Street, N.E., Washington 18, D.C.

* Suggested retail price, Port of Entry, Baltimore

STOP THAT DRAFT

Triumph TR-2 and TR-3 owners can prevent that TR backache by fitting the new Centurion combination windows and windwings. Made of aircraft grade plexiglass and aluminum, the new panels are built to last, while transforming any TR into a weather-proof coupe. They offer, according to the maker, 63 per cent more visibility and when stowed in the trunk take up far less space. With the full installation in place the top of the window has two sliding panels that can be used for ventilation or the complete half-window can be folded down. With the window removed, the rattle-free windwing can be used to prevent wind buffeting with top down. The whole business — windwing and upper and lower windows — can be stored upright in the TR trunk. For full details write Dept. SCI, Centurion Motor Products, 340 Canal Street, New York 13, N.Y.



TWO-MAKE CLUB

A club devoted exclusively to Corvette and '55-'57 Thunderbird owners has recently come to our notice. Called the Thundervettes, the group was organized in April of 1958, and at present has 54 very active members in some ten states. Included among the stock Corvettes and 'Birds owned by Thundervette members are some not so stock. Among the breathed-upon versions are two blown 'Birds, two blown Corvettes, blown Chrysler 'Bird, Tri-powered Pontiac Corvette, one 'Bird with the same engine set up, and a blown Caddie-Bird. Anyone interested in joining write the Thundervettes, Suite 204, 90-91 Sutphin Blvd., Jamaica, N. Y., and say SCI sent you.

FIAT ABARTH

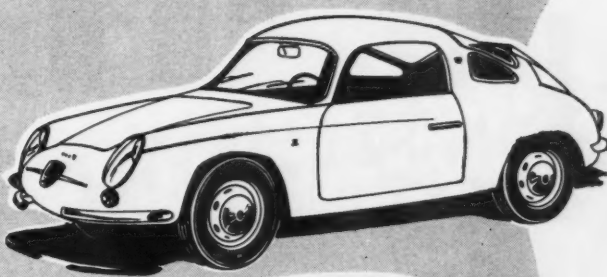
**APPROVED BY S.C.C.A. TO RACE IN 3 CLASSES
IN 1960 F, G AND H PRODUCTION!**



What other automobile can claim such versatility? Only FIAT ABARTH! In a FIAT ABARTH you are assured of long-acknowledged outstanding performance in every road situation . . . Touring, Rallying, Gymkhanas, Racing and Economy. No matter what your needs . . . FIAT ABARTH measures up to your standards.

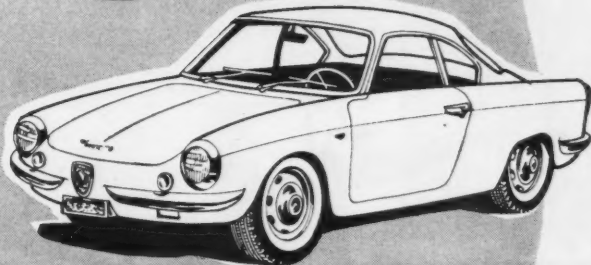
FIAT ABARTH 750 DUAL CAM RECORD MONZA

Approved for Class F production racing by SCCA for 1960. Superbly crafted, this car was raced in 12 Class H modified 1959 SCCA National events and placed in the top 3 each time. Featuring dual camshafts and 2 Weber carburetors . . . the Record Monza's total displacement is 747 cc with a compression ratio of 9.7/1.



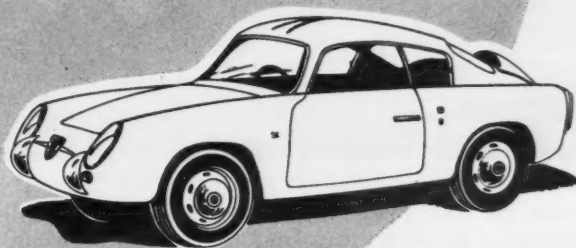
FIAT-ABARTH 850-S

Approved for Class G production racing by SCCA for 1960. This new FIAT ABARTH 850 cc pushrod engine develops 57 h.p. at 6,500 r.p.m. It is available in both the Record Monza Zagato body or the new Allemano coupe body introduced at the Frankfurt Auto Show.



FIAT ABARTH 750 cc ZAGATO

Approved for Class H production racing by SCCA for 1960. This car won the Class I production championship in 12 1959 SCCA National events . . . winning all races and one of the highest point totals ever accumulated by any driver . . . Paul Richards, the New York Times Small Car Champion for 1959. The single cam push-rod engine features a Weber carburetor, a total displacement of 747 cc, and a compression ratio of 9.8/1.



Team Roosevelt Has Chosen GOOD YEAR Racing Tires For The 1960 Season!

For Further Information See Your Fiat Dealer Or Write To

ROOSEVELT

AUTOMOBILE CO., INC.

Southeastern U.S. Distributor, Fiat - Fiat Abarth

2825 V Street, N.E.,

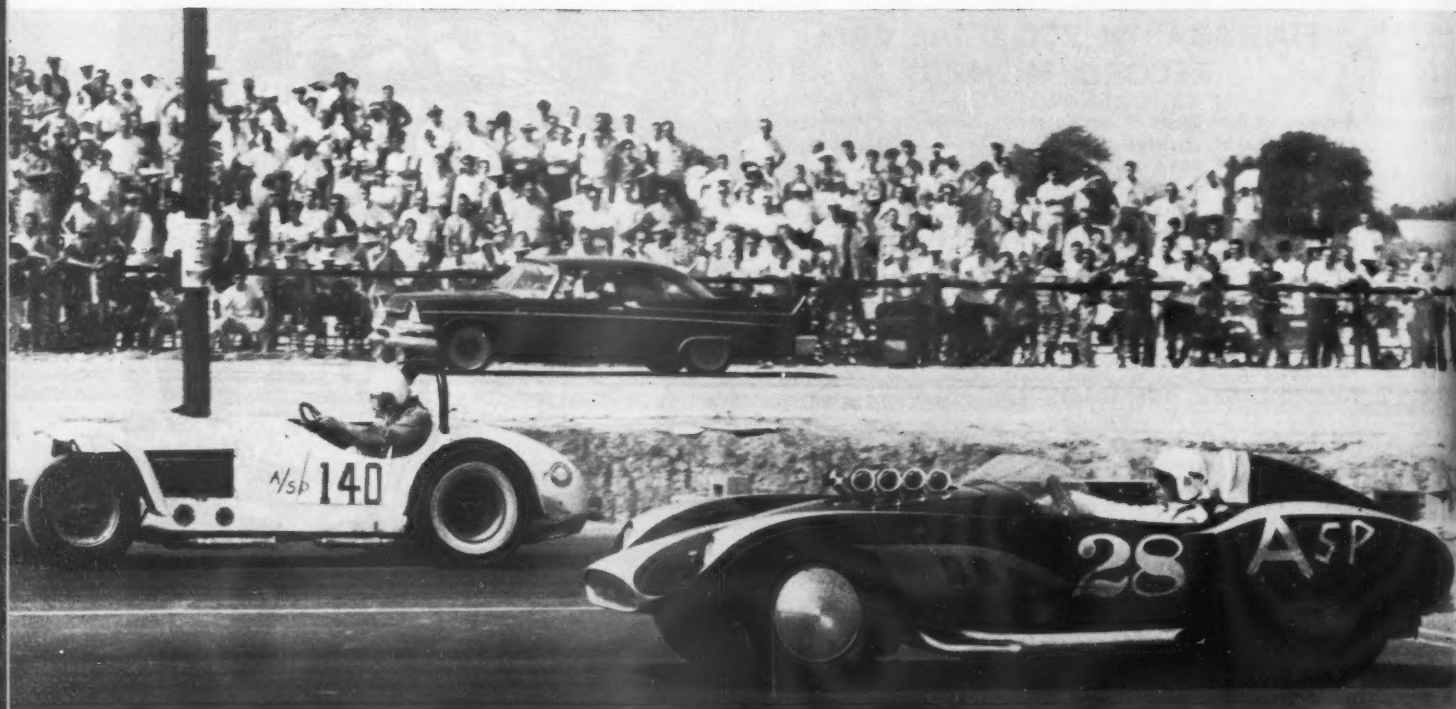
Washington 18, D.C.

Suggested Fiat Prices Start At \$1098 POE Baltimore

by Roger Huntington

STRAIGHT-LINE SPORT

Jack Horsley of Miami built a fire-breathing Lincoln-powered sports-dragster to make a mockery of existing sports car drag-racing classes. Here are 1960's new rules and a rundown of your car's chances.



► Sports car enthusiasts who like to compete in rallies, gymkhanas — maybe an occasional airport race — ought to take a crack at another ball: quarter-mile acceleration racing on the “drag strip”. Lots of drivers who have tried it say it has as much to offer as any of the other forms of competition — and it's a cinch it's a lot cheaper than airport racing!

The reason you haven't heard more about drag racing in the sports car field is very simple: for the last seven years the National Hot Rod Association, the organization that pretty much sets the pattern for drag rules and classes in this country, never bothered to set up a decent class system for sports cars. They may have had their reasons, or it may have been just an oversight, but it had the effect of discouraging most sports car owners from competing on the nation's commercial drag strips. Since classes were based on piston displacement only (not weight), and no distinction was made between production and modified cars, four out of five owners never had a chance.

Now all this is changed. For the 1960 season the N.H.R.A. has come up with a brand-new set of sports car rules and classes that should give *everybody* a fighting chance to win some gold. Since most of the nation's strips tend to follow

the N.H.R.A. lead pretty closely, we can look for a revolution in sports car participation in organized drag racing this year. You'd do well to look into it. Here's the low-down.

THE NEW CLASSES

We can thank Jack Horsley, Miami insurance broker and general lover of hot sports machinery, for bringing this serious sports car class problem to a head. He had been pleading with N.H.R.A. officials for years to do something about it — or at least make some distinction between production and modified cars. Finally, about a year ago he told N.H.R.A. president, Wally Parks, that he would demonstrate the inadequacy of the classes by building a thinly-disguised dragster, throwing a Devin fiberglass body over it so it would meet every sports car class requirement — then bring it to the National Championship drags at Detroit in September — and win the sports car division!

He did exactly that — and with a pretty fantastic machine. It had a light tubular frame, solid rear suspension with 37-inch tread width, early Ford beam front axle, Willys steering, Cadillac gearbox, with an overall weight of less than 1900 pounds. Over 400 bhp came from a bored and stroked 508-

(Continued on page 18)

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18/SPORTS CARS ILLUSTRATED/JUNE 1960

(Continued from page 16)

cubic-inch '58 Lincoln with Hilborn fuel injection and roller cam. The car has turned an elapsed time for the standing quarter of 11.46 seconds, with a trap speed at the finish line of 130.26 mph! At Detroit, Horsley ran his Devin-bodied "dragster" in the A/Sports class, 5200 cc and up, against bored and stroked Corvettes and T-birds and big-engine specials. He blew 'em all off with ridiculous ease.

Apparently he proved his point, in view of the new N.H.R.A. sports car classes for '60. We now have separate divisions for modified and production cars. Modifieds are classed only on displacement; Class A runs from 4801 cc (293 cubic inches) up, B runs from 3001 to 4800 cc (183 to 293 cubic inches), and C is under 3000 cc. Superchargers advance you one class. You have a lot of design freedom in this modified division. You can use fiberglass bodies, slick tires, magnesium wheels, locked rear ends, special frames, straight pipes and tonneau covers. But the spirit of the rules is that the car should be drivable on the street. You will need a windshield, upholstery, spare tire, lights, no solid suspension, and the car must start under its own power (no push cars allowed).

Also safety rules will be strictly enforced. You will need a substantial flywheel shield of 1/4-inch steel plate, extending 360 degrees around the bell housing, and attached to the frame (though you're allowed to use approved commercial bolt-on shields and safety bell housings). The top production sports class must also have a flywheel shield. On open-body cars a sturdy roll bar structure of minimum 1 1/2-inch o.d. and 1/8-inch wall steel tubing must be within six inches of the driver's head and extend at least three inches above the helmet when in normal seated position. Approved safety belts, anchored to the frame through minimum 5/16-inch steel bolts, plus an approved crash helmet are required on all sports cars. A shoulder harness is necessary in open bodies.

Actually, N.H.R.A. isn't as specific about allowable modifications from factory specs as are some sports car organizations. The top production sports class (Class D) can use slick tires and special rear axles, for optimum traction and gearing, but cars can have "no engine or body modifications". All sports cars must use "over-the-counter" factory catalogued parts, available to everyone with a maximum 30-day waiting period. No limited-slip differentials are permitted in E and lower sports classes. Mufflers may be removed in all classes, but piping is required to the rear of the vehicle. Before you take a stab at any of these new sports classes it would be a good idea to send 50¢ for the 1960 N.H.R.A. rule book; address 1171 N. Vermont Ave. Los Angeles 29, Calif.

An accompanying table lists the six new production sports classes and the more popular factory models that will fall in each.

1960 N.H.R.A. Production Sports Car Classes

Class D — 0 to 12.99 lbs./bhp
Corvette V8 (225 bhp and up)
'56-'57 Thunderbird (245 bhp and up)

(Continued on page 20)

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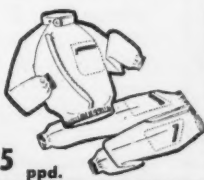
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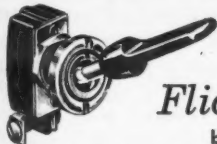
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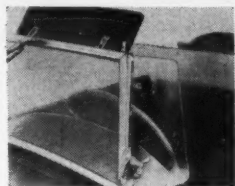
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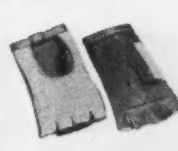
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AH, Jag., MG-A, TC, TD, TF, TR 2 & 3, AC, Corvette, Porsche, Aston-Martin, Morgan, Sprite, Alfa-Romeo 1300 only. Duralumin one-piece frame with rim made in contrasting laminations of light African Obechi wood and rich dark Mahogany. Hand French polished, finger serrations on the underside to ensure a firm grip. This wheel is slightly smaller in diameter (16") and allows an ease of handling not experienced with stock wheels. (Corvette, 17" dia.) No driver who has tried one has ever failed to express his enthusiasm for the distinctive Derrington wheel. The purchase price includes all necessary fittings.



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20/SPORTS CARS ILLUSTRATED/JUNE 1960

(Continued from page 18)

- Mercedes-Benz 300SL
- Jaguar XK (250 bhp), C, D, SS
- Porsche RS, RSK
- Lotus 1100 racing
- Ferrari G.T.
- Class E — 13.00 to 19.99 lbs./bhp**
- Corvette V8 and 6 (210 bhp and less)
- '55-'56 Thunderbird (225 bhp and less)
- Jaguar XK (210 bhp and less)
- '60 Austin-Healey (137 bhp)
- Daimler SP250
- Lotus Elite
- Porsche Carrera, Super 90, 1600S Speedster
- A.C. Ace, Aceca, Bristol
- Aston Martin DB
- Frazer-Nash
- MG Twin Cam
- Alfa Romeo Veloce, '59-'60 Super
- Class F — 20.00 to 24.99 lbs./bhp**
- Austin-Healey (through '59 6-port)
- Mercedes-Benz 190SL
- Sunbeam Alpine
- Triumph TR-2, 3
- Alfa Romeo Giulietta '59-'60
- Alfa Romeo 2000 Spider
- Porsche 1500S, 1600S, 1600 Speed.
- Class G — 25.00 to 31.99 lbs./bhp**
- MG A, TF-1500
- Alfa Romeo Giulietta (through '58)
- Porsche 1300S, 1500, 1600
- Austin-Healey Sprite
- Fiat-Abarth-Zagato
- Class H — 32.00 to 39.99 lbs./bhp**
- Fiat 1200 Spider
- Porsche 1300
- MG, TC, TD, TD Mk. II, TF-1250
- Class I — 40.00 lbs./bhp and up**
- Porsche 1100
- Singer
- Berkeley 2-cylinder

So now I'll go out on a limb and predict the top models — the consistent winners — in each of the six production sports classes:

- D — Corvette 290 bhp fuel injection
- E — Corvette '56 single 4-barrel (210 bhp)
- F — Austin-Healey Mille Miglia (121 bhp)
- G — Porsche 1600
- H — MG TD Mk. II
- I — Porsche 1100

It's hard to talk about the modified classes because car weight is not a factor in classifying. Thus, no matter how much horsepower per cubic inch you get out of your engine, another guy could take the same engine with less bhp, drop it in a backyard special that weighed 500 or 1000 pounds less, and beat you easily. Right off-hand, of course, past experience tells us that the late Corvettes will dominate both the upper modified classes — bored and/or stroked versions taking Class A (over 293 cubic inches and standard 283 cubic inches jobs taking B.

But I might make a suggestion about Class C (under 183 cubic inches). In view of the fact that several popular small-engined competition sports cars would be beating their heads against the wall in D/Production class against the late Corvettes (like the Porsche RS, Lotus, etc.) it might be practical to make some minor modifications on these cars that would put them in C/Modified. On Sundays when there weren't any 3-liter Ferraris or Maseratis around you could have a ball!

Why not get your feet wet in this drag sport and see what you think? —RH



©1960 VOLKSWAGEN

Lemon.

This Volkswagen missed the boat.

The chrome strip on the glove compartment is blemished and must be replaced. Chances are you wouldn't have noticed it; Inspector Kurt Kroner did.

There are 3,389 men at our Wolfsburg factory with only one job: to inspect Volkswagens at each stage of production. (3000 Volkswagens are produced daily; there are more inspectors

than cars.)

Every shock absorber is tested (spot checking won't do), every windshield is scanned. VWs have been rejected for surface scratches barely visible to the eye.

Final inspection is really something! VW inspectors run each car off the line onto the Funktionsprüfstand (car test stand), tote up 189 check points, gun ahead to the automatic

brake stand, and say "no" to one VW out of fifty.

This preoccupation with detail means the VW lasts longer and requires less maintenance, by and large, than other cars. (It also means a used VW depreciates less than any other car.)

We pluck the lemons; you get the plums.





New line of GM-built Holdens for 1960 includes this rugged station wagon. GM- Holden got early sales lead with first postwar car offered.

U. S. sales may be forthcoming for the handsome Ascort GT coupe, with a proven fiberglass body wrapped around a modified VW engine and chassis.



by Pedr Davis

MOTORING DOWN UNDER

22/SPORTS CARS ILLUSTRATED/JUNE 1960

Australia's booming market supports the "biggest 'little' motor industry in the world," and has propelled GM- Holden to 874.8 percent profits. Now more makers are vaulting aboard the bandwagon.

► Australia boasts the biggest "little" motor industry in the world. Despite a modest yearly output of 237,000 vehicles, the Australian motorist has a choice of no less than 67 basically different sedans, 31 of which are built locally. American, British, Czech, Austrian, German and French firms have established Australian plants, each tempted by the huge profits made by General Motors- Holden since it introduced the Holden sedans in 1948.

GM-H earned close to \$30 million for the last financial year, equivalent to 874.8% profit on its ordinary capital of \$3½ million. The company paid \$15 million back to its parent company which, incidentally, has not invested one dollar of share capital to finance the big postwar Holden project. A loan from the Commonwealth Bank of Australia played a key part in initiating this project and subsequent expansion plans have been financed by money plowed back from profits.

GM-H was the first company to manufacture an all-Australian car. The old Holden was a medium-sized, middle-priced sedan, with an overall length of 176 inches and a wheelbase of 105 inches. It was powered by a six-cylinder engine developing a modest 72 horsepower and was noted for its fuel economy. Australian motoring circles report some disappointment in the introduction of the new Holden. Sneak reports published throughout the country said the new model would have twin headlights and automatic transmission but it proves to be quite similar to the old, the biggest changes being wrap-around windshield and a bored-out engine.

It is also slightly longer, roomier and more powerful.

The six cylinder engine has been bored out by 1/16 inch, increasing the capacity from 132½ cubic inches to 138 cubic inches. The compression ratio has been increased from 7 to 7.25 to 1. Gross horsepower goes up from 72 bhp to 75 bhp at 4200 rpm, maximum torque from 110 lb-ft to 120 lb-ft at 1400 rpm.

Mechanically, the new model is substantially unchanged. The wheelbase remains the same at 105 inches but the overall length has been increased 5½ inches and the height reduced an inch. The curb weight of the Special sedan has gone up by 82 pounds.

Externally, the styling changes include an easier-to-clean grille, larger front and rear bumpers, a lower hood line (with a grille ventilator in the cowl) and a larger, more elegant taillight assembly. Thanks to new seat design, there is slightly more elbow room inside, though the overall width has been increased by only 1/8 inch. The new dash is a decided improvement and the dished steering wheel is designed to collapse in the event of a crash.

Repeated criticism of the Holden brakes has borne fruit, as the friction lining has been increased from 96 to 112 square inches, and the wheel cylinders modified to provide better braking balance.

Wider leaf springs at the rear and heavier coil springs are now fitted and the kingpins have been increased in diameter. Other engineering details include a new clutch plate, a dry element air cleaner and redesigned timing gears.

General Motors- Holden says it has spent a total of about \$11 million on the engineering and tooling for the new models, and the price of the new standard sedan in Australia has been set at \$2479.

(Continued on page 24)

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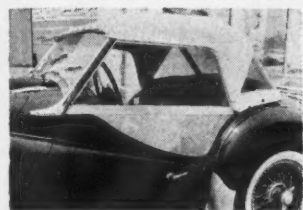


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MODEL
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MG TD & TF	80.95	43.50
Jaguar XK 120 & XK 140	89.95	47.50

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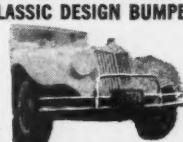


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(Continued from page 22)
industry could rise by as much as 10%.

The new range of models includes a special and standard sedan, a special and standard station wagon, a utility pick-up and a panel van.

The Holden's past success can be attributed to the design's attention to the unusual "Down Under" market requirements.

Australia presents an industrial enigma not easily comprehended. With a geographical area slightly larger than that of the United States, it has a population that barely tops ten million. It ranks fourth among the most highly motorized countries in the world and is the seventh largest producer of passenger cars.

The main cities are scattered along the coastline but there are some 518,000 miles of roads (not including those in townships and cities) throughout the commonwealth. Of these, only 47,000 miles are paved. A further 123,000 miles are surfaced with loose gravel and the remainder are either cleared bush tracks or "formed" from the natural state.

Consequently, cars sold in Australia must be designed for the very tough requirements of the terrain. Firm suspension systems are needed to withstand constant pounding over pot holes. The bodywork must be completely dust-sealed. Because of the danger from flying stones on loose surfaced roads, it is advisable to have a windshield that can be cheaply and quickly replaced.

GM-H's lead has now been followed by BMC and Chrysler, both of which now market cars specifically designed for this market. Volkswagen, Renault, Rootes, Simca, Peugeot, Ford, Standard-Triumph, Fiat, and Vauxhall also assemble and partially manufacture imported designs. There are in fact, no less than thirteen separate manufacturers building or assembling cars in Australia.

Inevitably, the point has been reached where the manufacturing capacity far exceeds the demand. Competition gets fiercer by the month and there are many indications that some of the small volume firms will be forced out of business. Anticipating even fiercer competition, the giants of the industry—GM-H, BMC and Ford—are engrossed in expansion plans designed to make their vehicles more competitive and—if necessary—less costly to produce. On the other end of the scale, such firms as Renault, Chrysler, Peugeot, Lloyd, Fiat and Skoda are battling to stay in business. Collectively, these six companies hold only 5.3% of the total market—a mere thousand vehicles a month.

General Motors-Holden on the other hand completely dominate the field. The Holden alone accounts for 40% of new car registrations and the combined sales of Vauxhall, Holden, Chevrolet and Pontiac are a fraction over half the total passenger and light commercial output.

At the end of the second world war, car-hungry Australia embarked on an immense import program which was largely satisfied by British firms, since the American industry was devoted to filling its domestic commitments. This in turn led to a fundamental change in local motor-

ing habits. Whereas in 1938 American-sized vehicles accounted for 78% of all sedans sold in Australia, today a mere 5% have wheelbases in excess of 108 inches.

The British motor industry and GM-H accounted for the change. After the war, GM-H planned an all-Australian car. The local company called upon the facilities of Detroit for the design and engineering but much of the development work was done in Australia. The vehicle was first produced late in 1948 and named the Holden, after a body firm GM had acquired in 1931.

The Holden success spread like a bush fire. By 1951 sales accounted for 23% of all registrations. Two years later the figure was 36%, then 39% in 1956. Last year, Holden topped the 50% mark for sedan and light commercial sales. GM-H has no intention of resting on its laurels. It has just completed another expansion plan designed to lift its percentage of the market still further.

Although the warning light of the Holden competition was glowing as early as 1950, both Ford and BMC were extremely slow in giving chase. Seven years ago, BMC had a 30.4% grasp on this market and it has slipped progressively until its sales in 1958 were a mere 12.6%. Ford too failed to hold its own, though its percentage slipped only a few points, from 15% in 1951 to 14.3% in 1958.

Volkswagen on the other hand has been making substantial inroads into the market since it began marketing in 1954. Already it holds 9% of the sedan market and sales are still rising.

The success of GM-H and VW can be attributed partly to sound merchandising but largely to first-class spare parts and servicing facilities. Being a large country with a sparse population, Australia has a serious spare parts problem. Before the war, the local mechanics earned a reputation for improvisation. They had to. Spare parts were hard to come by, except in major centers. When GM-H launched the Holden it established spare parts facilities in every nook and cranny in the commonwealth. In 1954 Volkswagen did likewise and the buying public quickly latched onto those cars for which adequate spares were available.

Paradoxically, although Australia is essentially a land of sunshine, very few open cars are sold. In 1958, for example, the combined sales of sports cars, convertibles and tourers accounted for only .05% of all passenger car sales. There is, however, a ready sale for sporty sedans, hard top coupes and Grand Touring designs. The Triumph Herald coupe, (a warm version of the Herald sedan), is one of the few cars sold here with a long waiting list.

BMC has recently begun to market cars designed exclusively for this market. Currently, its range includes the Austin A60 which is based on the Cambridge but has a larger engine and the Morris Major which is powered by the BMC 1½-liter engine. It is priced to compete directly with the Volkswagen.

Ford is rumored to have an all-Australian car on the stocks but currently the Zephyr is its volume seller.

(Continued on page 26)

DRIVE THE MGA 1600

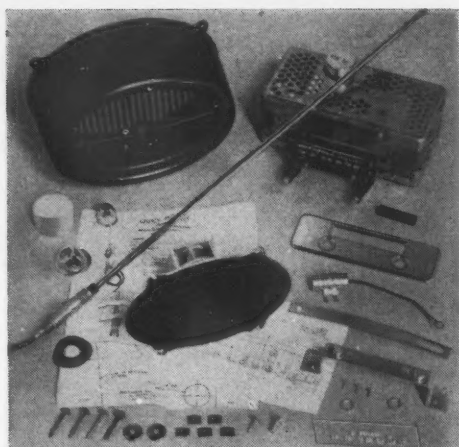
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Austin Healy	X	W	XYZ	XY	NSU Prinz		WXY	XYZ	XY
Borgward	X	WXY	YZ	XY	Opel	X	WXY	YZ	XY
Citroen		WXY	Z	XY	Panhard		W	Z	XY
Corvair		W	XYZ		Peugeot	X	W	XYZ	XY
Corvette		W			Porsche	X	WXY	YZ	XY
DKW		WXY	YZ	XY	Renault	X	WXY	XYZ	XY
Falcon		W	XYZ		Saab		WXY	XZ	XY
Fiat	X	W	XYZ	XY	Simca	X	W	Z	
Goggomobil		WXY	Z		Singer		W	Z	XY
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Mercedes		WXY	Z		Vauxhall		WXY	XZ	XY
MGA	X	W	XZ	XY	Vespa		W	Z	
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CITY ZONE STATE

(Continued from page 24)

Three very interesting high performance cars are built in Australia using imported mechanical components—the VW Ascort, the Buckle and the Goggomobil Dart.

The Ascort is a very stylish Grand Touring two door sedan, designed to cruise in silence. The Body is built from fiberglass and sits on a standard VW chassis platform. VW components are used throughout but the engine is modified with an Okrasa kit which boosts power to 54 horsepower at 4,300 rpm. Extensive use is made of polyurethane to dampen mechanical and wind noises.

The Buckle is based on Ford Zephyr components, with a warmer than stock engine and a fiberglass body. It has been most successful in competition events and the present design was evolved after several years' racing. The Dart, which is also built by Buckle Motors, is an unusually attractive miniature car, employing the German Goggomobil components. It is so small that no doors are fitted. The driver and passenger step over the sides into their seats.

Australia's future as an automobile exporter clearly lies in New Zealand, Africa, the Pacific Islands and certain Asian countries where the marketing requirements are akin to our own. GM-H has already made headway in this regard and are now selling a limited number of cars in 17 territories.

What lies in Australia for other U.S. manufacturers?

Very little. The cream has been scooped from the market and intense competition lies ahead. The motor vehicle productive capacity in 1959 was adequate to supply the estimated market until 1969. Despite this, the manufacturers already established in Australia are engaged in far from modest expansion plans. Chrysler has been devoting its talents to trying to market a Detroit-sized sedan called the Royal. Its percentage of the overall passenger car market has slipped from 10.9% in 1958 to 1.9% in 1958. In future Chrysler unquestionably will have to lean more heavily on the Simca or Valiant side of the family.

The only firms likely to challenge GM-H's supremacy in the foreseeable future are BMC and Ford. BMC has just completed a \$35 million expansion plan, which includes a completely new approach to their spare parts and servicing problems. Ford too is expanding rapidly and if it can produce a Zephyr-sized sedan priced closely to the Holden, it too will seize a larger share of the market.

At the present time, BMC markets no less than thirteen different passenger vehicles. Ford has eight. Undoubtedly these wide ranges seriously complicate the manufacturing, merchandising and servicing problems.

Holden and Volkswagen on the other hand wisely retained one basic model for several years, thus simplifying their production. Judging by the success of these two firms, it appears that the key to the future in Australia's unique market is a policy of one basic sedan per manufacturer.

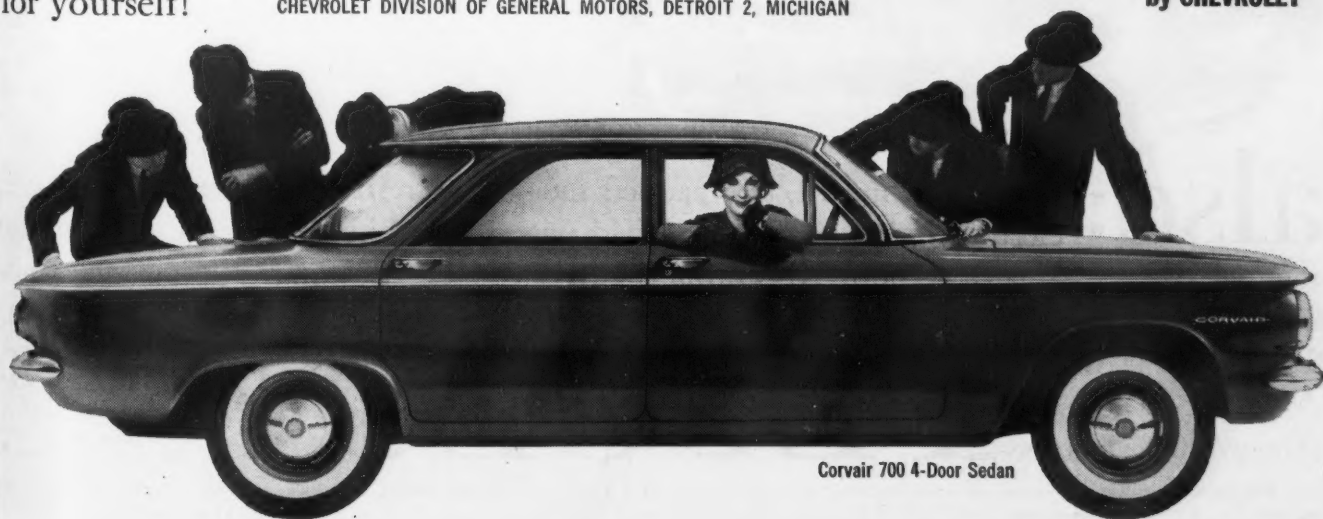
Motor Trend Award: Corvair by Chevrolet named "Car of the Year"! No other car even came close.

The editors of the world's largest general automotive magazine were unanimous in voting Corvair "the most significant car of 1960." Why? "For engineering advancement" . . . "four-wheel independent suspension totally unlike any other U.S.-built car" . . . a rear engine and transaxle "allowing a flatter floor and lower roofline." These are a few of the reasons given by the experts in announcing the industry's most coveted award in Motor Trend's April issue. But, unless you've personally driven a Corvair, you can't appreciate the happy combination of compact car economy and agility with big-car ride and room it all adds up to! Drop down to your dealer's . . . take a trial drive and judge the "Car of the Year" for yourself!

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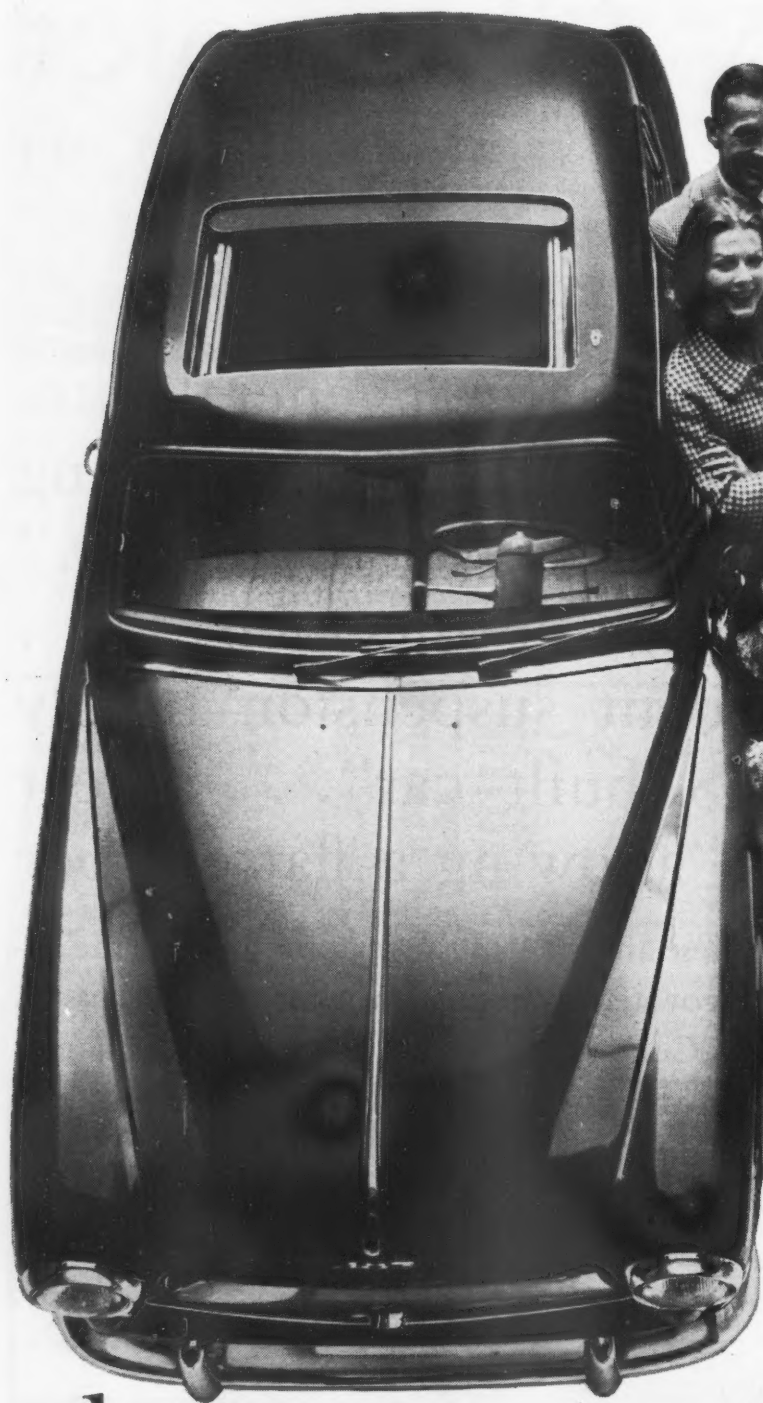
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EXPERIENCED BEGINNER

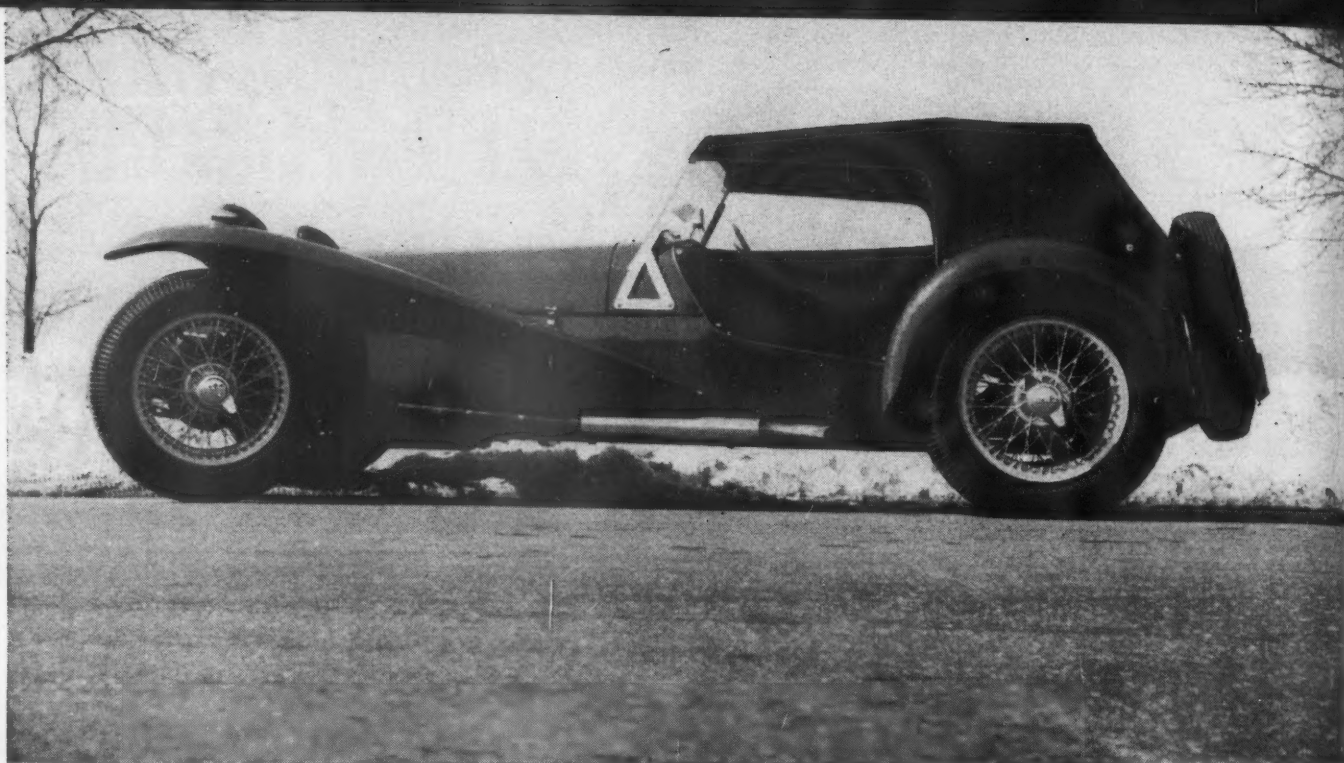
by Warren Weith

Indy driver Eddie Sachs is going to have a go at road racing. Here's why he'll probably do very well.



This season will see the introduction to road racing of untold hundreds of neophyte race drivers. Most individuals in this large unhomogenous group will share two things: an urge to compete, and enough self-confidence to believe that they can completely control a four-wheeled vehicle at speed. One person, different from the rest, will join these seminarians of speed this year. His name is Edward Julius Sachs. He will bring to the starting lines something, besides the two impulses mentioned above, that none of the other beginners possess. It is experience in guiding an open-wheeled race car down a less-than-a-mile straight at over 130 mph. The lessons that stocky, balding Edward Sachs had to learn to perform this deadly ritual were taught at dozens of oval tracks from one end of the country to the other. Eddie Sachs attended classes at quarter-mile midget tracks, lumpy, bruising dirt half-milers and horribly fast high-banked asphalt ovals.

(Continued on page 76)



ROAD TEST LOTUS SEVEN

► Most people think of a Lotus as a sleek, aerodynamic missile like the Eleven, the Fifteen or the Elite. But for two years Lotus has been building — in ever-increasing numbers — a small, inexpensive, all-around sports car called the “Seven”, which is just beginning to arrive in the States. Lotus has reverted to a one-number designation (at a time when the new rear-engined Formula car is called the Mark 18) to use the name that was saved for the successor to the square-cut Mark Six, the car that really put Lotus on the map as builders of competition machines. When written up by SCI in June, 1957, Lotus’s Colin Chapman ascribed the omission of “Mark Seven” to the fact that this was already being used by Jaguar, a fairly transparent ruse.

The original Seven followed closely the basic layout of the Mark Six, having simple body panels wrapped around its sturdy space frame, cycle-type front fenders and negligible weather protection. Now a special variant has been produced for the U.S. market and dubbed the “Seven America”. To adapt it to North American needs it has flared fiberglass front fenders that powerfully recall classic sports car lines. Less obvious are redesigned rear fenders, a thermostatically-controlled radiator fan, Elite-type windshield wipers, and the fitting of directional signals and big stop/tail lights. Several engines are fitted to the Seven in England, but the America comes standard with the full Healey Sprite engine, for which parts and service are readily available here. In our test car its power was transmitted by a Sprite clutch and gearbox to a BMC axle having a 4.875:1 ratio; other cogs are available to choice.

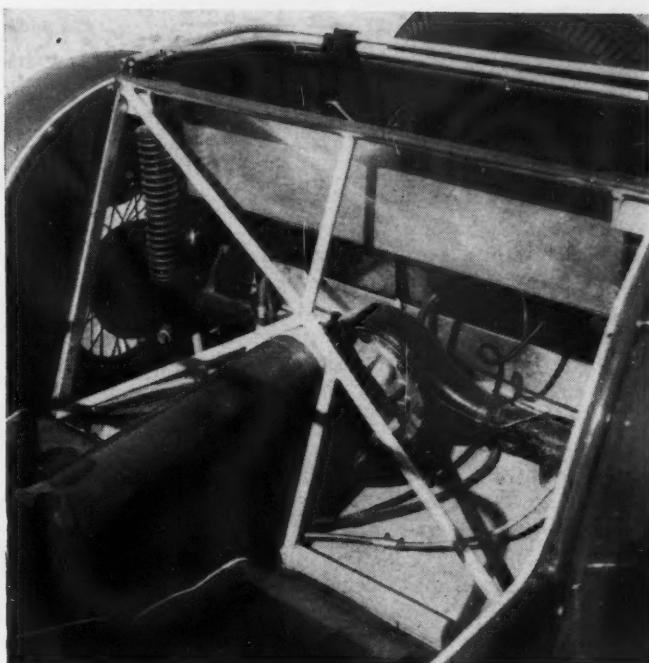
Like all other open Lotuses, the Seven has a Chapman-designed space frame. The front suspension is the now-standard Lotus parallel-wishbone layout, with the anti-roll bar forming one leg of the upper wishbone, while the live back axle is guided by parallel radius rods and a diagonal member. Springing is by coaxial spring/damper units at

all four corners, and steering is by rack and pinion. The two-leading-shoe brakes work in eight-inch drums, bathed in a plentiful supply of cool air. Seen overall, this collection of time-proven machinery resembles a hybrid of an MG TC, a K-2 Allard and a California dragster. It’s a basic vehicle, purely sporting, with an epidermis of red-painted aluminum encasing a businesslike mechanism. It makes no pretense to Detroit’s — or, for that matter, Coventry’s or Turin’s — creature comforts. It’s as spartan and unadorned as a row-boat.

Even before the engine is started it’s obvious that this is an enthusiast’s car. Since there are no doors, you step over the low cockpit side and shoehorn yourself into the non-adjustable seats. These have only an inch or two of padding atop a very firm surface and are a mere 16 inches wide, so they’re a very snug fit. You’re so low that you can press a palm flat against the pavement from the cockpit, and you’re braced firmly in place by the prop shaft tunnel and the side of the body. In spite of the lack of adjustment, the seat position seems to accommodate varying heights efficiently, and the sparse cushioning is surprisingly comfortable. There’s a carpet on the floor with rubber mats under the driver’s heels, but this is the only concession to comfort. Everything else is intended for just one thing: driving.

Set at arm’s length, the steering wheel is pleasant to use but its ivory plastic design seems out of keeping with the rest of the Seven. Its diameter is good; in fact it couldn’t be larger or even a skinny driver couldn’t get in the car, except through a trap door in the bottom. Neatly grouped on the dash are the speedometer, oil pressure gauge, water temperature gauge and ammeter, a tach being optional either in place of or in addition to the speedometer. The short shift lever is ideally placed within a few inches of the wheel — though its shift pattern was felt to be too lengthy — and

(Continued on page 87)



Sparse instrumentation sets the tone for the Lotus Seven concept. It is all car without frills—meant to be driven hard just for the fun of it. In the process the flared fenders protect the driver during wet weather.

Solid rear axle can be reached for service by removing the plywood seat back. A modest amount of luggage can be stowed under the tonneau cover just aft of the seat, although it must share the space with canvas top.

ROAD TEST

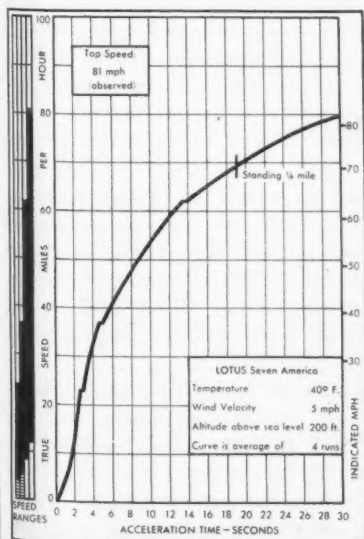
LOTUS Seven America

Price as tested: \$2795

Importers: Lotus Cars of America, Inc.
4110 Lankershim Blvd.
North Hollywood, California

Suburban Foreign Car Service, Inc.
1907 Susquehanna Road
Arlington, Pennsylvania

European Motors, Inc.
8811 East Jefferson Ave.
Detroit 14, Michigan



ENGINE: (BMC A-type)

Displacement 57.8 cu in, 948 cc
Dimensions Four cyl, 2.48 x 3.00 in
Compression Ratio 8.3 to one
Power (SAE) 48 bhp @ 5200 rpm
Torque 52 lb-ft @ 3300 rpm
Usable rpm Range 800-6000 rpm
Piston Speed \pm v/s/b 2365 ft/min
@ rated power
Fuel Recommended Premium
Mileage 26-35 mpg
Range 220-290 miles

CHASSIS:

Wheelbase 88 in
Tread, F, R 47 in
Length 132 in
Suspension: F, ind., coil, wishbones inc. anti-roll bar; R, rigid axle, coils, radius arms.
Turns to Full Lock 1 1/2
Tire Size 5.20 x 15
Swept Braking Area-drum 126 sq in
Curb Weight (full tank) 960 lbs
Test Weight 1300 lbs
Percentage on Driving Wheels-laden 62%

DRIVE TRAIN: (BMC A-type gearbox and rear axle)

Gear	Rev	Syncho?	No	Ratio	Step	Overall	Mph per 1000 rpm
				4.66		22.74	3.1
1st		No		3.63		17.69	4.0
2nd		Yes		2.37	53%	11.57	6.2
3rd		Yes		1.41	68%	6.88	10.4
4th		Yes		1.00	41%	4.88	14.6

Final Drive Ratios available: 3.73, 3.89, 4.22, 4.55, 4.875, 5.125, 5.375 to one.



► Lotus Elites had an enviable competition record in 1959, and one of the most successful cars in European events was Peter Lumsden's which won the 1300 cc G.T. class in the Nürburgring 1000 Km. race and the 1500 cc class at Le Mans — all during the owner's annual vacation. In the 24-Hour race the dark-green Elite covered nearly 2300 miles, and as well as winning the 1500 cc category against strong sports-racing opposition it finished eighth overall and second in the *Coupe a l'Indice au Rendement Energetique* — a classification based largely on fuel consumption. What better car to try as an example of an Elite modified for racing?

Regular SCI readers will be aware that the Lotus Elite is unique among European cars in having an all-fiberglass chassis/body structure, containing very little in the way of metal other than engine and suspension mountings and a tubular hoop around the windshield. To this shell are attached the standardized Lotus wishbone and coil spring front suspension and the independent "Chapman strut" rear end. Power unit is the well-known Coventry Climax single-overhead-camshaft engine, enlarged to 1216 cc and designated FWE, mated to an MGA gearbox.

Peter Lumsden's car was a pre-production prototype which did a lot of development work before being stripped, rebuilt and sold to him at the start of the 1959 season. For this reason the sceptics regarded his visit to the bumpy,

The chief, and almost only, departure from standard on Lumsden's is the fitting of a Stage III cylinder head (see page 38 of this issue), with its five-bearing camshaft, together with twin 1½-inch SU carburetors on special intake manifolds and a four-branch exhaust manifold. Compression ratio is 10.5 to 1 and maximum power is raised from 75 bhp, at 6100 rpm to 102 at 7000. For long-distance events an oil cooler was fitted, together with baffles around the rear brake discs to direct heat away from the interior of the car. To combat under-hood heat a small aluminum duct was fitted to provide cool air for the carburetors. In character with the "racing" engine, close-ratio gears were fitted; surprisingly enough these proved to be quieter than the standard gears.

One of the secrets of Peter Lumsden's success was the car's complete reliability. At the Nürburgring the Elite ran faultlessly, building up an early lead in its class and increasing it as the Alfa-dominated entry was forced to stop for tire changes and brake adjustment. On some sections it proved — due to its excellent handling — to be as fast as the leading Aston, and faster than some of the Ferraris. Peter and his co-driver, Peter Riley, drove to a set lap time, and this proved to be high enough for them to win the class by eight minutes.

The same approach to long-distance racing paid off at Le Mans, where no mechanical work of any description was necessary throughout the twenty-four hours. During each 32-lap session the Elite used 15 to 17 gallons of gas and two to three pints of oil. On Sunday morning the radiator and gearbox were topped-up — just for good measure — and that was all. The target speed was maintained throughout the major part of the race, and toward the end it was possible to slow down considerably and still maintain the class lead.

Although the Elite is so low-built, the big, wide-opening

doors simplify getting in and out, and once inside there is ample head- and leg-room, even for my 6 feet 4 inches. There is also a surprising amount of luggage space, both in the deep rear trunk and inside the car, where the spare wheel is carried — out of sight — on a ledge beneath the rear window. Trunk and hood lids have over-center hinges and stay open without supports, and hood-opening provides easy access to most of the items requiring regular attention.

The driving position is fairly upright, with the seat well away from the very pleasant, wood-rimmed steering wheel. The seats are comfortable but don't provide a great deal of lateral support for people of slender build, and although the deep propeller shaft tunnel helps in this respect, Peter Lumsden has had small padded side-pieces fitted at the junction of the seat cushion and back-rest.

The control and instrument layout is almost ideal as standard, and thus Peter Lumsden has seen no reason to change it. The pedals are well spaced, with ample room for the left foot below the clutch. The accelerator extends downwards to facilitate heel-and-toeing. Below and to the left of the clutch is a foot-operated dimmer switch, with a windshield-washer plunger alongside it.

The short gear-lever protrudes from the transmission tunnel within a few inches of the steering wheel, and the gearshift — although rather stiff initially — has loosened up considerably as a result of its racing use.

Directly ahead of the driver is the comprehensive instrument panel, with matching 8000 rpm tachometer and 140 mph speedometer flanked by a fuel gauge on the left, a

(Continued on page 78)

ROAD TEST LOTUS ELITE

chassis-breaking Nürburgring as a waste of time. But the car emerged from this ordeal, and the less exacting day-and-night at Le Mans, with colors flying, although its differential housing had come adrift a few weeks earlier during a club meeting at Silverstone! In such ways are faults discovered.

Another aspect of the car's prototype nature is the bonking transmitted through the rear suspension units and the general level of noise which results from an absence of sound insulation. In addition the exhaust note, with the small racing muffler fitted, becomes very "sporting" above 4000 rpm, and also gives rise to resonances inside the car which might be less tolerable on a touring run than on the race track. On current production cars the bonks have been eliminated and the noise level has been considerably reduced, but a certain amount of resonance remains, as does gearbox and transmission noise. Of course, some people regard these items as essential features of sports car motoring.

Even in standard form, of course, with a single carburetor engine, the Elite is no mean performer and probably has better handling than any other small closed car — and a lot of open ones too. Its Girling disc brakes stop it from speed in incredibly short distances and its light, positive controls make it enjoyable to drive under all conditions.

In view of all this, Elites require far less modification to turn them into successful racing machines than the majority of production cars. The standard car behaves so well in the wet, and even on snow, that the chassis can obviously take more power without any snags arising. And these are exactly the lines on which Peter Lumsden worked when he went about having his Elite modified for use as a "racer."



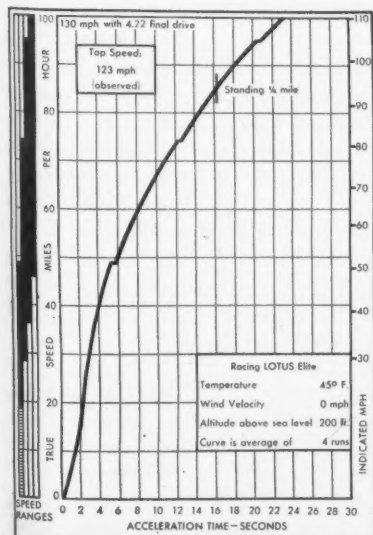
Peter Lumsden's Lotus Elite is taken through the Esses during the running of the 1959 Le Mans race. Its happy owner came home first in class.

ROAD TEST

Racing LOTUS Elite

Price as tested: \$5700 (\$5169 basic)

Importer: Lotus Cars of America, Inc.
4110 Lankershim Blvd.
North Hollywood, California



ENGINE: (Coventry Climax FWE)

Displacement74.25 cu in, 1216 cc
DimensionsFour cyl, 3.00 x 2.62 in
Compression Ratio10.5 to one
Power (SAE)102 bhp @ 7000 rpm
Torque82 lb-ft @ 5000 rpm
Usable rpm Range2800-7300 rpm
Piston Speed $\div \sqrt{s/b}$ 3270 ft/min
@ rated powerSuper-premium
Fuel Recommended20 mpg
Mileage (Le Mans)335 miles
Range

CHASSIS:

Wheelbase88 in
Tread, F, R47 in
Length150 in
Suspension: F, ind., coil, wishbones incorporating anti-roll bar; R, ind., coil, strut.
Turns to Full Lock13 1/2
Tire Size5.00 x 15
Swept Braking Area—disc302 sq in
Curb Weight (full tank)1375 lbs
Percentage on Driving Wheels—laden56%
Test Weight1705 lbs

DRIVE TRAIN: (BMC B-type close-ratio gearbox)

Gear	Syncho?	Ratio	Step	Overall	Mph per 1000 rpm
Rev	No	3.67	—	16.69	4.5
1st	No	2.45	—	11.15	6.7
2nd	Yes	1.62	51%	7.37	10.1
3rd	Yes	1.26	29%	5.73	13.0
4th	Yes	1.00	26%	4.55	16.4

Final Drive Ratios: 4.55 to one standard.
3.70, 4.22 and 4.875 to one optional.



► After building technically-advanced front-engined cars for more than ten years, Colin Chapman has at last gone over to a rear-engined layout on his Formula Junior Lotus. There is nothing particularly novel about the design — which suggests that this car could be a winner right from the start, with no need for the painful development period which innovations often require — and it is in fact one of the simplest and neatest inspired by the new formula.

Lotus's reasons for adopting the rear-engine scheme are explored in detail in the Formula 1 car review on the next two pages, so suffice it to say that the changeover has been made without substantially changing either weight distribution or roadholding. This I discovered when Colin Chapman invited me to Goodwood to try the prototype during a testing session.

Colin himself, Development Director Mike Costin and Team Lotus driver Alan Stacey all tried the car during the morning, experimenting with a variety of anti-roll bars, shock absorber settings and tire pressures, and when all three seemed fairly satisfied I was allowed to do a few laps to see how the first rear-engined Lotus behaved.

The chief purpose of the outing to Goodwood was to

for Lavant, going through the first part of the corner at about 4000 rpm and reaching 6000 rpm soon after the left-hand kink on the straight. Only very gentle braking was needed for Woodcote, where a large puddle on the exit was a little disconcerting, and after the shift down into third for the Chicane the power could be put on very early, with the tail sliding only a little toward the barricade and needing very little correction.

6000 rpm came up in third by the beginning of the pits, and just under 6000 in top matched my cutoff point for Madgwick. The car was very little affected by the bump in the middle of this two-part corner and was soon up to 5000 rpm again on the exit from the second part. It reached 6000 just before Fordwater and stayed above 5000 rpm all the way to St. Marys, where it seemed as steady as a rock despite the adverse camber, emerging from the left-hander at about 4000 rpm and accelerating hard down the dip toward Lavant.

The roadholding can only be described as extremely good. When the tail slides out, in the dry at least, there doesn't seem to be any need for sudden correction, and it's possible to go through sharper corners pretending to be "doing a

TRACK REPORT LOTUS FORMULA

test roadholding and handling characteristics rather than to set up lap records, so a limit of 6000 rpm was set for the moderately-tuned Ford 105E engine. As a "Brands Hatch" axle ratio (4.7 to 1) was fitted I was warned that this would mean backing off slightly on Lavant Straight and perhaps at Fordwater.

With a total length of 133 inches and an overall height of only 34½ inches the Lotus is one of the smallest Formula Junior cars, but one of the advantages of mounting the engine at the rear is that ample space is left for the driver. My 6 feet 4 inches fitted in quite easily fore and aft, with plenty of room both at shoulder level and around the pedals. As Colin Chapman and Alan Stacey also drove the car in exactly the same trim the seating position is obviously very versatile.

The control layout is conventional, with the small, leather-covered steering wheel almost at arm's length but well away from the instrument panel, the pedals well-spaced and the short, Renault Dauphine gear-lever conveniently placed on the left.

The ignition switch is on the right, with the starter button below it, but to save the battery I was push-started in second gear. The engine fired immediately and the car accelerated away briskly, with the needle of the Speedwell electronic tach swinging 'round extremely smoothly and dropping back with never a waver after the shift up into third, and then top.

The gearshift — with first and second on the right, third and top on the left — proved to be very pleasant, though after the first lap I was only changing down to third for Lavant Corner and the Chicane, and doing the rest in top. Later I found that it wasn't even necessary to shift down

Jack Brabham" without any fears of losing it altogether. Roll is scarcely apparent, except perhaps at the Chicane, though at Madgwick and Fordwater the scenery does seem to be leaning over somewhat. With a very low center of gravity and a fairly hefty anti-roll bar one would hardly expect body roll of sedan proportions, however.

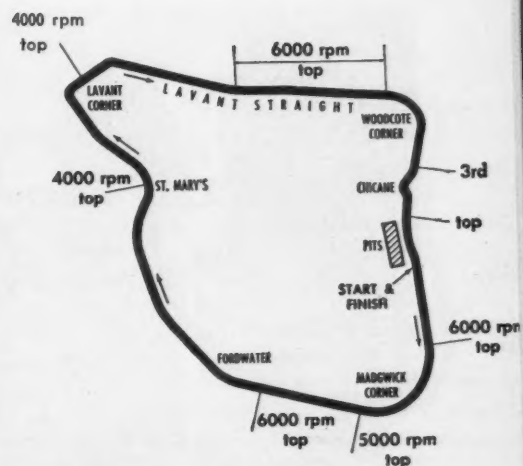
As it has been "built heavy" to comply with the weight limit regulations, the Formula Junior Lotus looks and feels very strong. Just to prove this point Colin Chapman jumped up and down on the radiator. "It's not every car you can do that on", he said. But even though it's thus considerably heavier than is really necessary, from a design point of view, it accelerates very rapidly — particularly in the upper speed range where the small frontal area begins to pay dividends.

During my brief run the brakes seemed rather fierce, but the system is due for slight modification before a full production specification is drafted. Alan Stacey summed up the braking, when asked if he thought there was too much on the front or too much on the rear, by saying briefly, "Just too much". The occasion on which I needed the brakes most was when I came through Fordwater to see a vast, black, shapeless mass extending right across the track. As I slowed the mass suddenly dispersed, as hundreds of crows took off and wheeled away to the south.

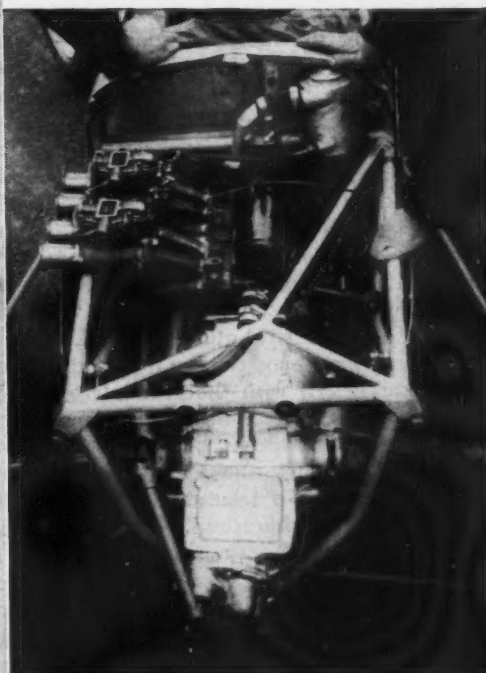
Formula Junior is obviously going to have a big appeal for young — and not so young — drivers, and the Lotus will certainly be among the chief contenders for honors in this category. It's a most enjoyable car to drive, and with its quick, precise steering seems extremely controllable and free from any kind of vice. But the most surprising thing about my run is that I was never really aware that it was a rear-engined car.

—D.P.

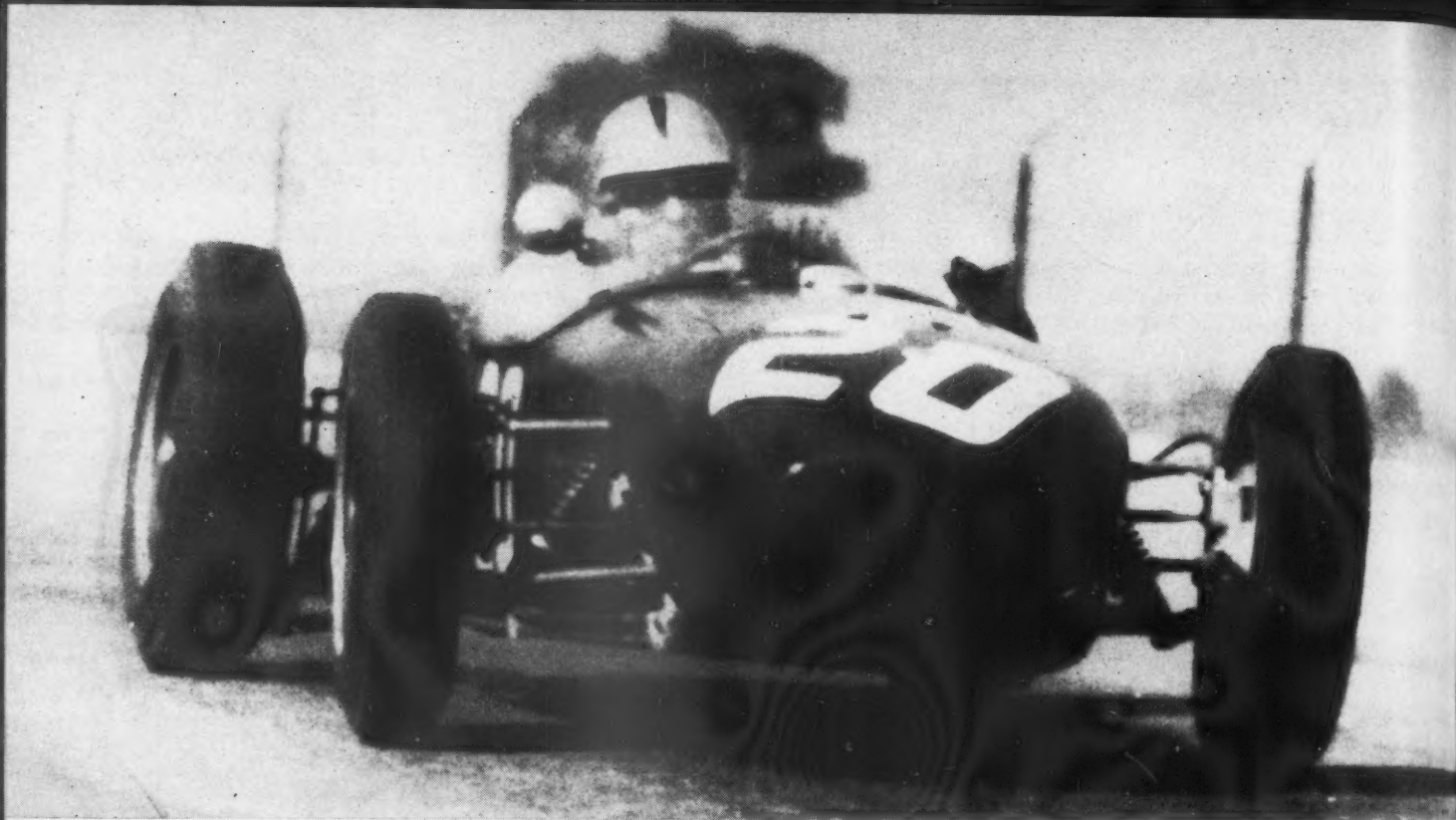
JUNIOR



In top gear, and traveling fairly fast, the Lotus F. Jr. goes through Woodcote corner on England's Goodwood circuit in a display of good handling.



The new Lotus is powered by a Ford 105E engine. Small, short stroke, Anglia power plant is ideally suited for F. Jr. with a strong lower end design.



TECH REPORT

LOTUS FORMULA 1

by David Phipps

► It is generally acknowledged that the 1959 Formula One Lotus was one of the most advanced — and at the same time one of the most disappointing — Grand Prix cars yet produced. In theory it had all the requisites of success: light weight, small frontal area, aerodynamic bodywork, clever, all-independent suspension giving extremely good handling, and adequate if not unmatched power. The biggest problem was getting the power to the rear wheels via the offset transmission layout. This was considered essential, in a front-engined car, to keep frontal area and the center of gravity low. Constant-velocity joints might have helped reduce the power loss, if it had been possible to obtain suitable ones, but delivery dates in England were such that once the season had started Lotus was stuck with its original layout, come what may, for the rest of the year. Troubles were also experienced with the gear selector mechanism and the chassis, which was taking tremendous loads under braking from Grand Prix speeds.

It was decided to make a clean break for 1960, and start from scratch again instead of adding further complication in the way of modifications. The essential requirements were to minimize power losses, to reduce frontal area to an absolute minimum and to keep the center of gravity right down. The only answer was to put the engine near the rear wheels and to make the frontal area roughly that of the seated driver; the rest followed.

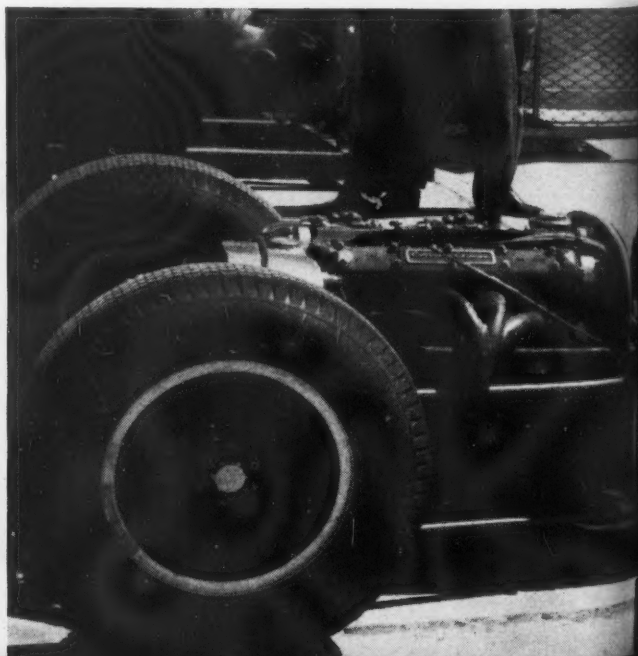
STILL SPACE-FRAMED

Though the new car is so different from the 1959 model, the overall conception remains typically Lotus and many

tried and tested parts are incorporated. The chassis is a space frame made up of 1-inch and $\frac{3}{4}$ -inch (mainly straight) round mild steel tubes, with a fabricated cowl hoop and a small fabricated frame at the extreme rear. No extreme weight-saving measures have been adopted, so the main tubes are of 16 and 18 gauge steel, whereas in the past it was Chapman's practice to use a considerable amount of 20 gauge material.

Basically the chassis consists of three sections. Within the forward section the front suspension bay is fully triangulated

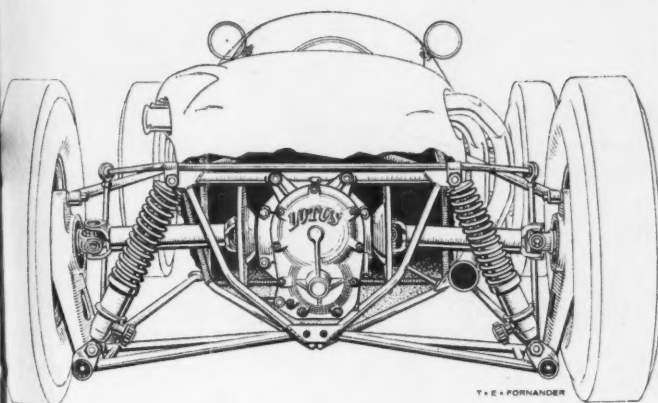
The main 22 gallon fuel tank is located in the upper part of the



WHY REAR-ENGINEED MR. CHAPMAN?



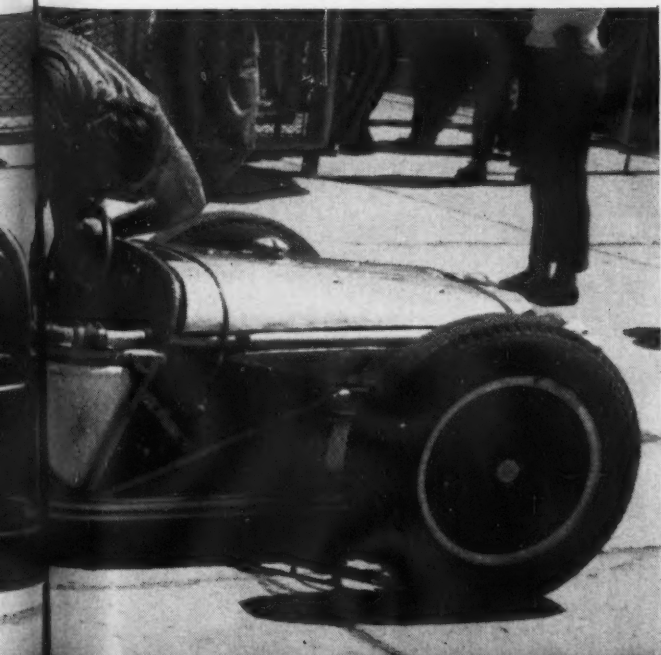
SCI correspondent David Phipps interviews Colin Chapman on the design features of the new Grand Prix Lotus.



and forms a complete structure in itself. Ahead of it is a separate, lighter structure which carries the radiator, oil tank and body supports.

Welded onto the forward end of the front suspension bay are the rack-and-pinion mountings, the brake and clutch master cylinder mountings and the leading front suspension bearing mounts. Attached to the rear of this bay are the rearward front suspension mounts and supports for the brake and clutch pedals.

nose. Small 9½ gallon gas tank is placed alongside the driver.



●D.P. Colin, have you any particular reasons for going over to a rear-engine layout for your 1960 Formula 1 car, or are you just following the current trend?

●C.C. No, I wouldn't say that at all. We've reached the stage where we've decided — in view of the size and facilities of the firm, and our numerous other commitments — to go for a basic, simple and easily-maintained design rather than a technically superior but more complicated one. The rear-engine layout offers several advantages for a Formula 1 car: low frontal area, a low center of gravity (with no drive shaft problems) and minimum power loss through the transmission. The chief disadvantage of such a car is that it has a low polar moment of inertia.

●D.P. Why have you made provision for mounting the rear brakes outboard? Wouldn't this result in a considerable increase of unsprung weight?

●C.C. This is mainly a thermal problem. It's just a matter of how successful we'll be in maintaining low underbody temperatures in the engine compartment. The body is designed so that air will enter the engine compartment through the hole at the rear, and flow forward from this high-pressure area over the gearbox, brakes, clutch and engine and out through the hole in the undertray — the underside of the car being a low-pressure area. But if there's any danger of the rear brakes overheating we'll mount them outboard, despite the increase in unsprung weight. The hub-castings are drilled so the calipers can be bolted straight to them.

●D.P. Are there any other reasons for the rather unusual body styling?

●C.C. In designing this body we had three things in mind. First, minimum frontal area commensurate with covering the essential parts of the car — especially the fuel tanks. Second, the promotion of maximum air flow over parts needing cooling. In addition to the items I've mentioned, this really means designing the front of the car around the smallest suitable radiator, and channelling the air out so that it doesn't cook the driver. The third factor was to keep the weight down by keeping down the acreage of aluminum.

In cross-section the shape was dictated by the need to combine minimum frontal area with maximum radius of gyration of the chassis. This latter means getting the four main longitudinal tubes as far apart as possible, to give maximum chassis stiffness. Thus the two conflicting requirements — maximum stiffness and minimum frontal area — have produced a square shape.

●D.P. Apart from the body design, are there any other novel features on this car?

●C.C. The only really new feature is the double-transverse-link rear suspension. In practice, the fore-and-aft members are only radius arms, and the suspension geometry is dependent on the transverse links. The upper one is the drive shaft and the lower one controls camber angle and toe-in.

●D.P. The most important question, of course, is: How do you think the new car will go?

●C.C. Well, it's still rather early to say, but Innes Ireland's performance in Argentina was extremely encouraging, and I think that the hot-weather testing we did there will prove its value in the European season.

Up-staging older Coventry Climax "fire pumps" takes the parts shown below — plus something extra. Here are the full details.

CLIMAX: STAGE III

By Lou Delaney



PARTS REQUIRED

Part Number	Description	Quantity Per Engine
SAFWA 2128	Piston Assembly	4
SAFWB 3061	Con-Rod Assembly	4
FWB 1120/2	Con-Rod Bolt Tabwasher	4
FWA 2006/5	Bearing Cap, Front and Rear	2
FWA 2007/5	Bearing Cap, Center	1
FWA 1005/7	Exhaust Valve Seat Insert	4
FWA 1024/4	Exhaust Valve Guide	4
FWA 1023/6	Intake Valve Guide	4
FWE 1013/7	Intake Valve	4
FWE 1021/7	Exhaust Valve	4
FWC 1121/3	Inner Valve Spring	8
FWC 1032/3	Outer Valve Spring	8
FWC 1022/4	Valve Spring Collar	8
FWC 1031/3	Valve Spring Cup	8
SAFWC 3052	Tappet Block Assembly	1
FWC 1007/3	Tappet	8
FWA 1548	Tappet Block Packing Washers	9
SAFWA 3060	Camshaft Assembly	1
FW 1018	Camshaft Bearing, Front and Rear	4
FWC 1019/5	Camshaft Bearing, Center	6



► The FWA Coventry Climax 1097 cc single-overhead-cam engine has long been the dominant power unit in international Class G racing. These engines have been used in Lola, Lotus and Elva cars, and have more than proven themselves to be extremely reliable and among the least expensive units to maintain in high-performance racing tune.

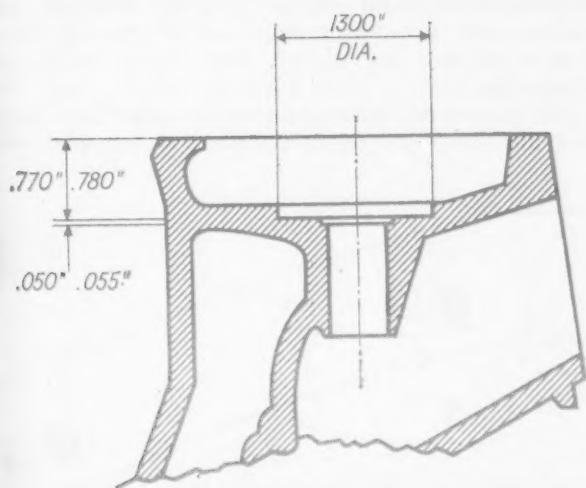
After several racing seasons with the little FWA still chugging along in its standard Stage II tune, the designers sought out ways to improve its performance. When the factory at Coventry began producing the engine in a Stage III tune, few owners were ready to throw away their then-obsolete Stage II units. We certainly couldn't afford it, running a team of Lotus Elevens, and as soon as parts became available we began our conversions. Those of you with Coventry engines might like to know just how this is done in a "do-it-yourself" fashion. There are two major phases: the block modifications and the head modifications.

BLOCK MODIFICATION

The major modification to the block assembly is the fitting of the heavy-duty main bearing caps. The front and rear caps differ from the center one and may be recognized by their thickness: front and rear caps are 1.1 inches in width; the center one is 1.23 inches wide. With the caps in marked position and torqued to 450 lb-in, the assembly must be line bored to 2.26875/2.26925 inches.

When full balancing is completed, we may begin the short block assembly. In fitting the crankshaft, the end clearance must be checked. If clearance exceeds 0.010 inch, new thrust washers must be inserted. The main caps are then installed and torqued to 440-450 lb-in. Crankshaft clearance on the mains is from 0.001 inch to 0.00275 inch.

In disassembly, you may have noticed small marks on the front and rear inside edges of your cylinder liners.



These have been caused by valve float in the high rpm ranges. This will be extremely dangerous in the Stage III engine, so you must file relief notches 3/32-inch deep on the front and rear inside edges of your liners, approximately one inch in length. This is what Dick Stockton is doing in the large photo on the opposite page.

Before fitting the new Stage III piston and rod assemblies, it is necessary to check the small-end bushes and ream them in position to 0.750 ± 0.0002 inch in diameter. When fitting the wrist pins, warm the pistons to 80° to 100° C for ease in assembly. This can be done by placing each piston in a pan of boiling water or by playing a torch gently over the entire crown of the piston until spit will boil off.

For sprint racing, we recommend a looser fit of the pistons to eliminate excessive friction in the higher rpm ranges, and also as partial protection in the event of overheating

the engine. Piston clearance at the thrust face should vary from 0.007 inch at the top of the skirt to 0.005 inch at the bottom. Compression ring end gap: (in position in the cylinder liners) 0.018 inch to 0.020 inch; oil scraper ring: 0.012 inch to 0.014 inch. The piston-rod assemblies are now fitted to the crankshaft and torqued to 280 lb-in. Big-end clearance: 0.002 inch to 0.0035 inch. After several rotations of the crankshaft to ensure freedom of movement, the remainder of the short block assembly may be completed.

HEAD MODIFICATION

The head modifications that give us an increase in power output necessitate the use of a fine machine shop and a few hours of dedicated patience. We shall, for simplicity, do this in the following stages.

A) Assuming you are now running standard Stage II compression, it is necessary to shave .040 inch from the underside of the head to increase the compression ratio to 10.5 to 1. It will then be necessary to use packing washers — sized in relation to the amount of the head cut — underneath the tappet block to retain tension on the camshaft driving chain and also to ensure correct valve timing. We now use super-premium because of the higher compression. When the race organizers give away gasoline, we take what we're offered, but the rest of the time we try to get Atlantic Imperial or Esso Golden Extra.

B) With the new five-main-bearing camshaft and tappet block assembly, larger and stronger valve springs are used. The existing valve spring cup recesses in the head must be enlarged as shown in the diagram.

C) To remove and replace the valve guides the head should be heated to 150° C. This is 300° F and if you're doing this part of the job at home, you can use the kitchen stove. If not, play an acetylene torch over the entire head (don't hold the flame at one spot) until you can get the old guides out with gentle taps. Use a drift 0.5 inch in diameter which will allow free passage through the valve guide bore. The new bronze guides are then inserted. The correct amount of projection is 0.350 inch above the machined valve spring cup recesses in the top of the cylinder head.

D) To change the exhaust valve seats, drill two holes 180° apart using a drill of a slightly smaller diameter than the radial thickness of the insert. A small chisel is then used to cut away the remainder of the valve seat. This must be executed with extreme caution so that the machined surfaces of the valve seat recesses aren't damaged. This done, the head is again heated to 150° C and the new seats chilled for ease of installation. Finally the exhaust seats are ground to 45° and then hand-lapped with a fine grinding compound.

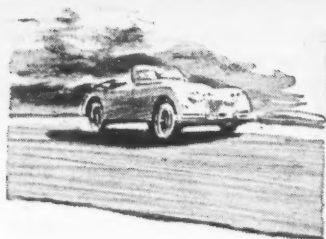
FINAL ASSEMBLY

With these head modifications finished, we may now complete the assembly of the engine. If you have exceptionally smooth, flat surfaces on both head and cylinder block, you can try this trick: spray both sides of the head gasket with an Aerosol can of aluminum paint. Use enough to get a tacky surface, assemble the head and torque it to 240-250 lb-in.

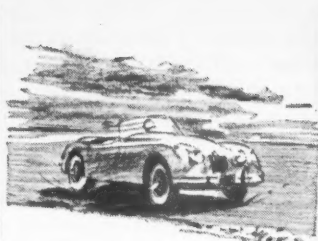
Torque the camshaft bearings to 160-180 lb-in and adjust the valve clearances to .005 inch intake and .007 inch exhaust. The spark timing remains unchanged at 2 to 3 degrees BTDC. The factory puts a timing mark on the front pulley but if your engine is not brand-new, there may be several there. If so, use a dial indicator on piston No. 1 or No. 4 as explained in SCI, July, '59.

After starting, let the engine run about a minute and a half before filling the water system. This ensures a good seal at the head gasket. After the engine has run about 30 minutes, stop it and re-torque the head bolts while it is still hot. After a few hours of running, check the tappet clearances and adjust accordingly after the valves have had a chance to bed down.

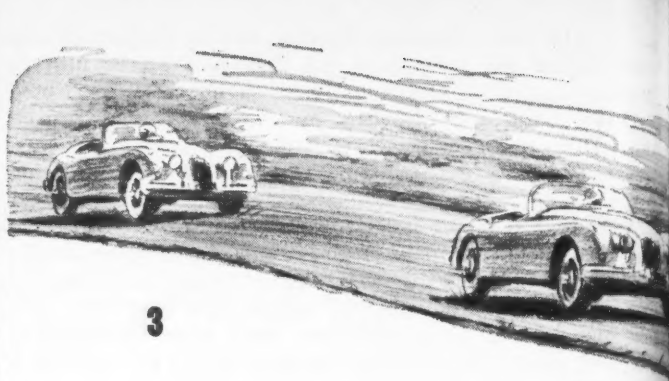
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DRIVING THE JAGUAR



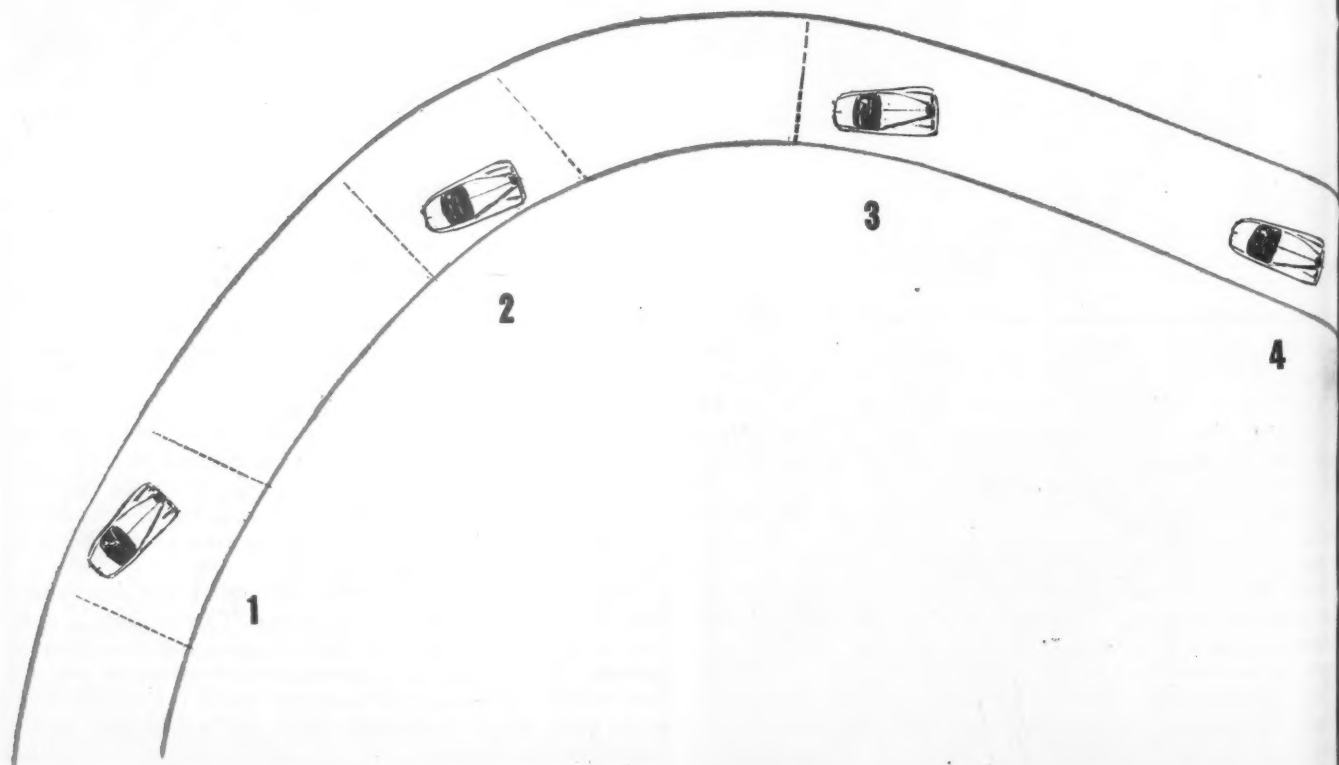
► One of the most difficult — and sometimes embarrassing — aspects of being a race driver is that people are constantly asking you “How do you do it?” and “How can I learn to be a race driver?” Of course the answers to these questions all depend on who is asking them. If I were to give the beginner

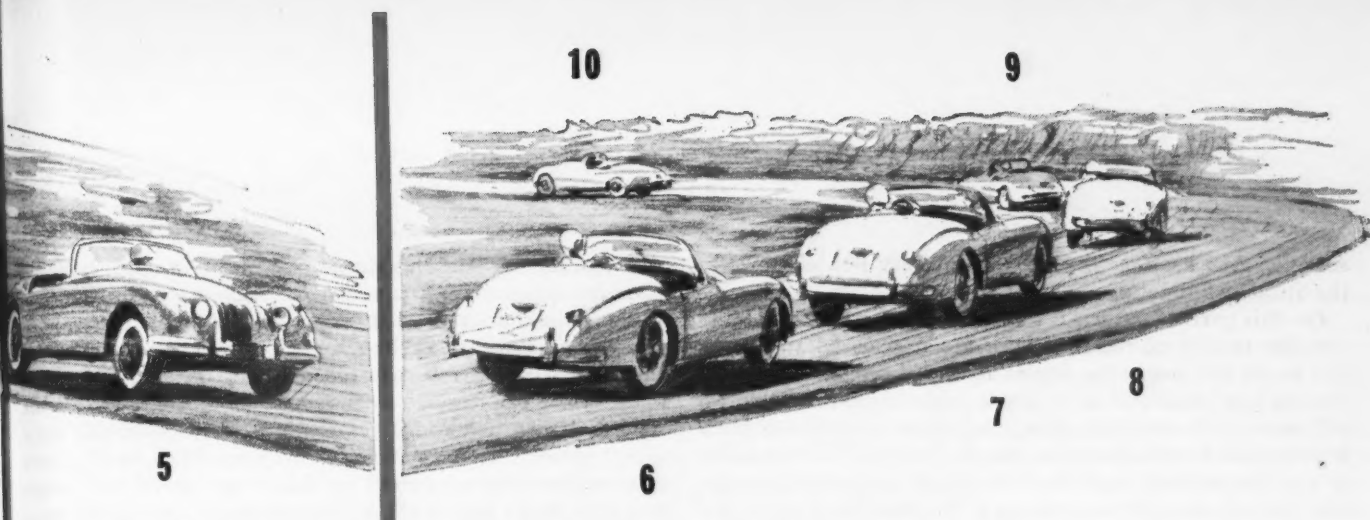
a really complete answer it would take not minutes but weeks, and he would probably die of boredom along the way. But since you readers of *SPORTS CARS ILLUSTRATED* are certainly not beginners I will assume that you already know how to drive a sports car with better than average skill — meaning that you already know how to use the gearbox and

brakes to good effect and that, at the very least, you are aware of the importance of proper cornering technique in sports car road racing.

With this behind us we can proceed to the specific problems at hand — namely the handling of a production Jaguar on the Lime Rock circuit in Connecticut. For this story we chose the XK 150S roadster because it's the most powerful production Jaguar available. I personally am glad that this series deals with production cars rather than sports-racing cars because in an important way this presents more of a challenge to the driver. I think most of my fellow drivers will agree that unless you drive smoothly you'll never be able to record consistently good lap times. And it is much more important to be smooth in a production car than in a modified car. We will find out the reasons for this presently.

If you look at the illustrations you'll notice that they're divided into three categories — cockpit positions, placement



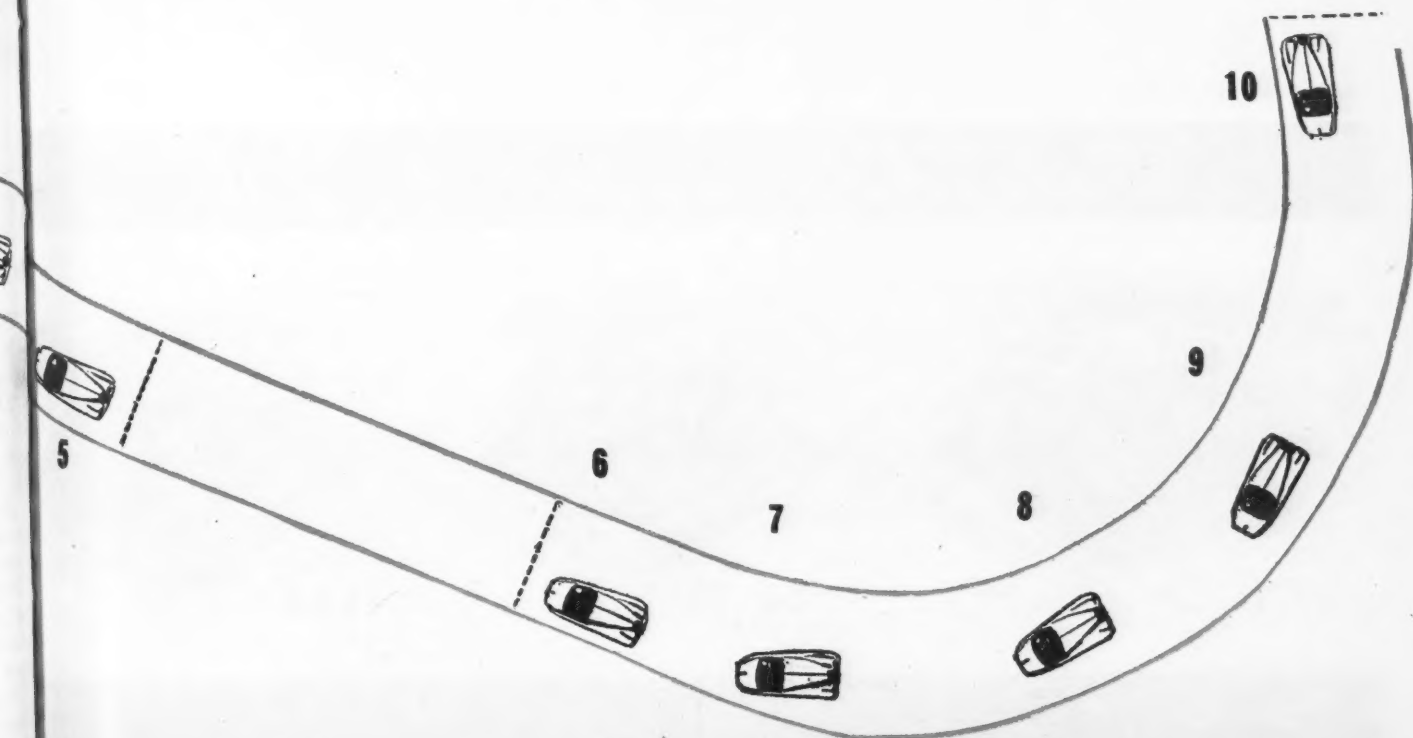


IN COMPETITION by Walt Hansen

of the car on the road, and the actual path of travel, or "line". In the case of the last two there are numbers from one to 10; you therefore get two separate views of each step along the way. In addition there are six illustrations of what is going on in the cockpit during travel through the 10 points. Thus you will be able to follow the text nicely, and should get a complete picture of what car and driver are doing at all times. Now for the actual driving.

The first turn confronting us is known as the Hook. Actually this is the second part of what is often (and erroneously) thought of as one long turn at the end of the main straight at Lime Rock. If you try to drive around it as if it were one turn, though, you'll be in trouble. The correct procedure is to approach the first right turn at the end of the straight from the left-hand side of the road, in third gear. If your approach and speed are right you'll cut to the inside of the turn and your momentum will carry you, sliding, over to the left. This is position number 1.

Note that for position 1 the steering wheel is cut just slightly to the right; it has been straightened out somewhat after the first right turn was negotiated. Now, with the car roughly four feet from the left side of the road — the rear wheels are a bit closer to the left than the front ones — we are going to "set up" the car at the correct angle for its slide around the Hook. This is accomplished by turning the wheel further to the right (as in the cockpit drawing for positions 2 and 3) and stepping harder on the throttle. Now, the Jaguar is a rather heavy car — over 3,000 pounds — and one that normally understeers. That is, it tends to break loose and slide the front wheels first. But we don't want to let it slide too far because that extra weight will tend to carry us too far to the outside (left), or possibly off the road entirely, wasting time and — even more important — horsepower, as we attempt to correct for the over-slide. What we actually want to do, then, is set up a "throttle oversteer" that will bring the tail around rather



sharply, thus keeping the nose of the car headed towards the inside of the turn.

On this particular turn it's extremely important not to go past the middle of the road with the Jaguar, because from this point the pavement begins to dip down and away on the left-hand side and if we get on this "downhill" side we will waste still more horsepower trying to stay on the road. We must be careful, however, not to feed too much throttle or cut the steering wheel too far to the right because this will put the car sideways or spin it altogether. What we are aiming at, with regard to position 2, is to have the car two to three feet from the right-hand side of the road, pointed slightly towards the inside of the curve. If, in the middle of the curve, we see that the tail is swinging out too far, we back off on the throttle a little. If the tail isn't coming around enough we add more throttle. But we don't change the steering wheel setting; once it is set at the beginning of the Hook it stays there through the entire turn. I do not "saw" at the steering wheel (If you have entered a turn too fast, though, this is one way of slowing the car down.) although I do have to jiggle the wheel now and then — no more than an inch — to compensate for irregularities in the road surface.

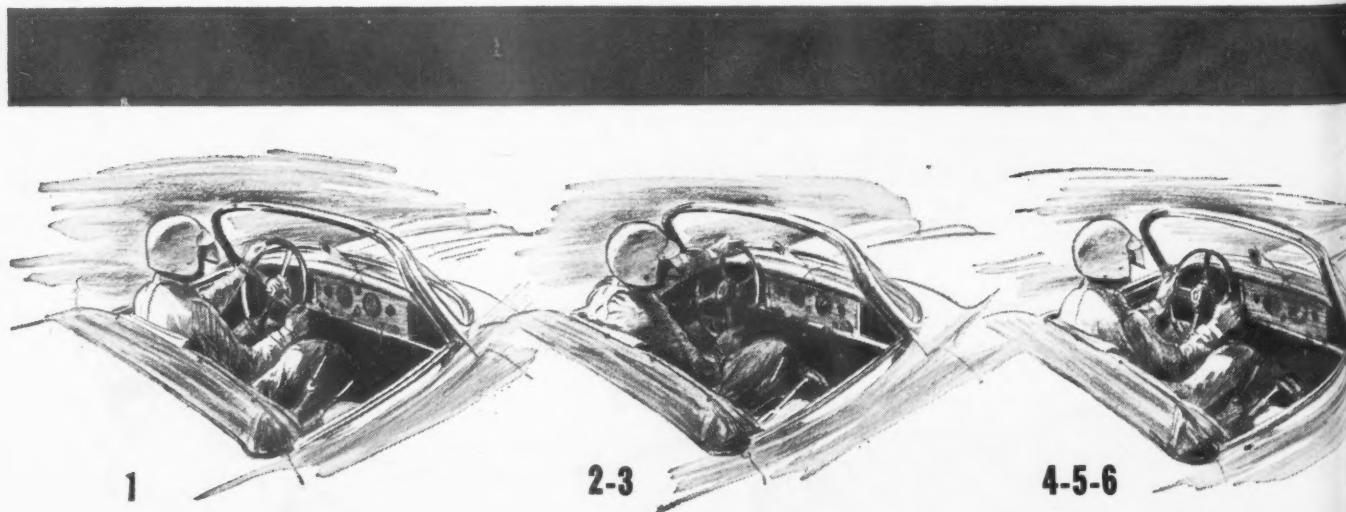
We begin to see here what is meant by smoothness. If you are constantly setting and resetting the wheel position and throttle opening, the car will be all over the road. The tires will be "scrubbing" rather than rolling and this friction will rob you of horsepower which, in turn, will slow you down. In a modified car there is more horsepower to waste, and you can afford to be a bit more extravagant with it, but in a production car there is a much narrower margin for error. You don't have the power to make up for your mistakes. Whenever there's a decision as to how to take a partic-

ular corner it's the horsepower waste that you have to consider. In our "throttle oversteer" sliding technique we do waste some horsepower in spinning the rear wheels fast enough to make them lose some of their traction sooner than the front wheels, but the total loss is less than if we allowed the car to slide sideways across the left side of the road and then had to fight our way back across to the right side, "uphill." Another factor to be considered in this turn is that if we slid too far to the left in an actual race someone else might take our line on the inside and get past us. If the road were wider and completely level we could get around the turn faster by going a bit further left but as it stands, with the Jaguar at least, we must allow the left-side wheels to go no further than the middle of the road. This puts us in position number 3.

Now we're no longer turning, or at any rate we don't want to be. We back off on the throttle slightly to stop the rear-wheel slide and to get a good "bite", at the same time beginning to straighten out the wheels (as in the drawing for cockpit positions 4, 5 and 6). Then we stand on the throttle and head, at a slight diagonal, towards the right-hand side of the road going into the next, sweeping left turn. At position 4 we've crossed about half-way over — the wheels are cut straight — and at position 5 we're parallel with the edge of the track, about four feet from the right-hand side.

Now at position 6, still going straight, we jab the brake once and then, getting back hard on the throttle at about 3800 rpm, flick the steering wheel sharply to the left, as in the cockpit drawing for position 7. This maneuver "cocks" the car for the long slide around to the left, but we must be careful to back off immediately on the steering wheel. At the same time the throttle is "feathered" to maintain the

DRAWINGS: GEORGE JANES



correct slide angle. (This is not a "drift"; we're not going fast enough.) In other words, we "toss" the car momentarily and then "set" the steering wheel, just as we had set it going into the Hook. (The first time you head into this turn, actually the first part of the Esses, the line shown will seem wrong. It will appear that you should be diving for the left-hand side of the road sooner, but the turn is too long for that. If you went left too soon you'd find that when you were about two-thirds of the way around the turn the car would begin sliding to the right. Even if you were lucky enough to stay on the road you'd be set up all wrong for the approach to the right-hand bend that forms the second half of the Esses. And you would have to waste more of your precious horsepower to correct for this error.)

When you "toss" the car at position 7 you have to be careful not to toss it too hard because if the tail comes around too far the car may go sideways, out of control. The result — more horsepower down the drain. Once again we're faced with the weight problem; we are *throwing* the Jaguar out to the right early so that it doesn't *slide* to the right later on, when we don't want it to. But we don't want to throw it too far, either, because, just as with position 2, we don't want to have to fight our way back across the road. In effect, what we want to do is throw the car just far enough so that it will stay more or less in the center of the road all the way around the left bend until the curve begins to straighten out. Then, if we have maintained the proper "slide angle" all the way around as we progressed — crablike — forward and to the right, it will be a simple matter, at position 9, merely to drive straight to the left side of the road, with very little fighting against side thrust. The proper angle is maintained by opening and closing the throttle, more or less, rather than by changing the

setting of the front wheels, which would set up excessive scrubbing. It cannot be described much more specifically than this; you have to "feel" it.

At position 10 we should be traveling in a straight line about three feet from the left-hand edge of the road (any closer is too bumpy on this particular turn) pointing, hopefully, towards the right-hand bend which forms the second half of the Esses. Although this curve is beyond the scope of our necessarily-limited story I will mention that it is a fairly sharp right-hander that dips away on the outside, as does the Hook, and which must be taken on the inside with the Jag.

Naturally, all of this is merely the *ideal* way to drive the Jaguar. In reality, it's just about impossible to take the same bend exactly the same way each time. There are too many variables like traffic, changing road surface, tire wear and pressures (I use 50 psi in front and 40 in the rear), car balance (which changes, as fuel is used, during a long race), speed (you may not always be *trying* to lap at the same speed, depending on what the other cars are doing), and human error. Nor is this article meant to be a do-it-yourself shortcut to a lap record at Lime Rock, or any other course. No matter what your degree of talent, you must be thoroughly familiar with any car and any racing circuit before you can even begin to think about going quickly. What I have attempted to do is acquaint you with the basic problems involved in driving the Jag through some typical bends and show how the problems are solved. Or, to put it another way, this is what you should make the car do in order to get it through this section of road properly at racing speeds, assuming that you have the necessary skill and experience to perform each maneuver correctly once you have learned the essential steps.

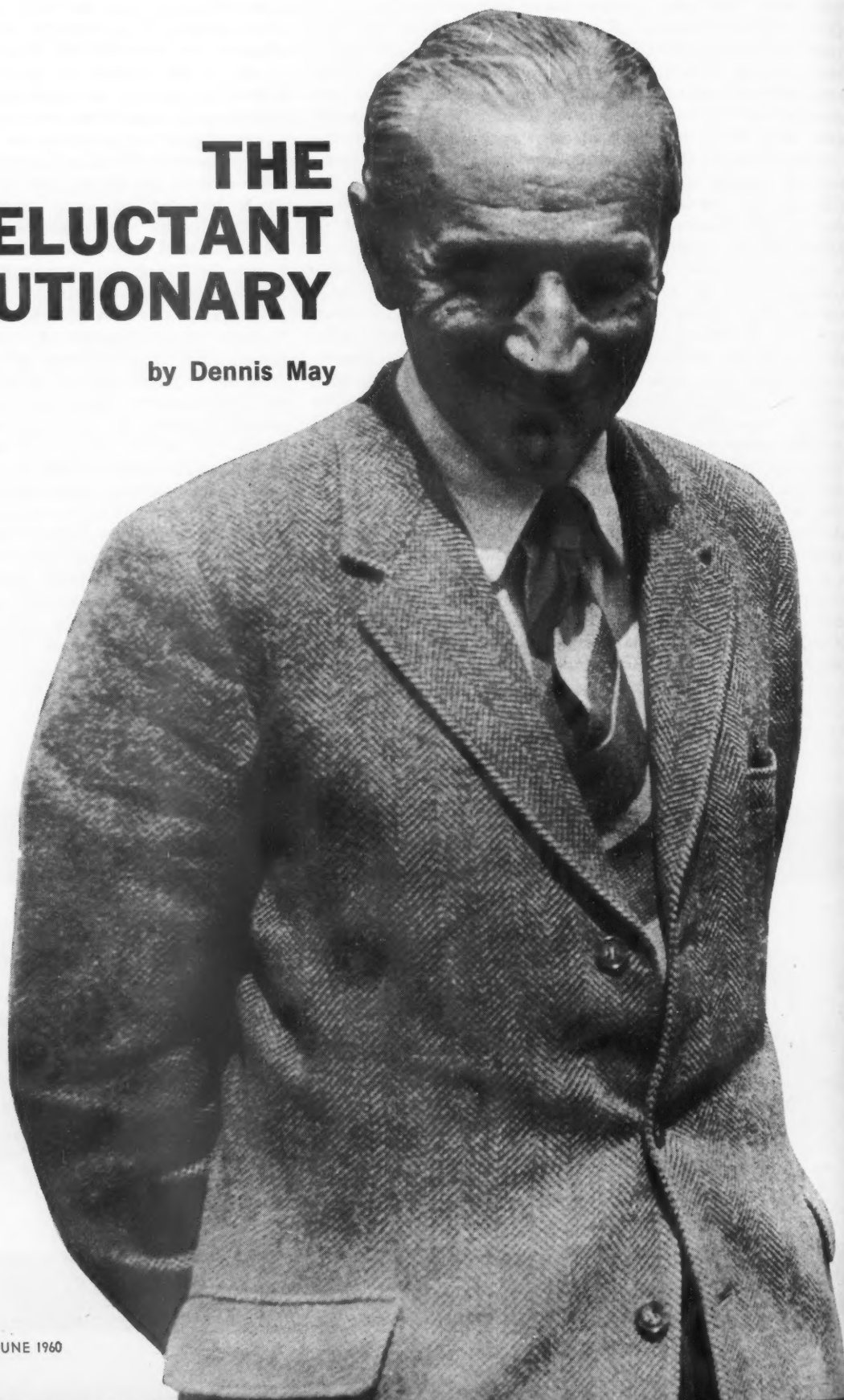
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"If it works, don't change a thing" is the favorite precept of Alec Issigonis, who designed and built a brilliant racing car, then followed through with the Morris Minor and BMC's latest front-drive babies. Trouble is, nothing ever works quite well enough to satisfy this fertile-minded perfectionist.

THE RELUCTANT REVOLUTIONARY

by Dennis May



► When the designer-builder of a brilliant racing car turns to doodling production automobiles, and the result sets an all-time and all-types sales record for its motherland, you don't have long to wait for an exhumation of the deathless platitude, "racing improves the breed". It's just a question of which parrot can get beak to typewriter first. Recalling Alec Issigonis's sensational Lightweight Special of the Thirties, they said it when he fathered the best-selling Morris Minor in '48. Eleven years later, jostling the font at the christening of his mid-century twins, the Morris and Austin 850's, they gave the old cagebirds' chorus a second rendering.

In fact, among those qualified to express an opinion either way, almost everyone except Alec Issigonis has at some time cited the Issigonis story as a particular proof of the general thesis that racing improves the breed of passenger cars. He himself not merely refutes it, both on his own behalf and in overall terms, but makes red faces redder by demonstrating the contrary.

Detached and objective at a time when, under the hypnotism of Berlin propaganda, most of us could see nothing but inspired originality in the design of Germany's prewar Grand Prix cars, Issigonis was pointing out to anyone who'd listen that the Mercedes racers' wishbone and coil spring i.f.s. was nothing else but Buick's 1933-et-seq. knee-action in a light disguise. Moreover, although the Mercedes debut under the 750 kilogram formula had occurred *after* Buick endowed cars with knees, it had taken the Stuttgart engineers a year or two to get around to their act of plagiarism: for a start, they'd used a much inferior system of their own.

Prowling observantly around the Nürburgring paddock during vacations from Cowley in Germany's racing heyday, it also struck this son of a Greek father and a German mother that the Daimler-Benz method of constructing a racing chassis frame, using welded-up box sections rather than channels and rivets, reflected up-to-date knowledge of and respect for contemporary Detroit practice.

Early in 1947, when he was the Nuffield Group's chief development engineer, Issigonis was able to refresh his memory and enlarge his knowledge of immediate prewar German thinking on Grand Prix car design. En route from its homeland to the U.S., a 1939 W163 Mercedes-Benz abided briefly in Britain, of which country Issigonis was and is a naturalized citizen (he was born in Turkey). In an analysis of this machine, which he was given an opportunity to inspect, sit in and crawl over, he blithely debunked the racing-improves-the-breed cliché for AUTOCAR readers' benefit. Also, with or without fear of contradiction (none was forthcoming, anyway), he ventured to criticize the basic architecture of the W163 on the grounds that the use of a separate body and chassis not only involved an unnecessary weight penalty but also impaired accessibility (. . . "the main side members appear to be continually getting in the designer's way"). The reason nobody contradicted him was that, as far back as 1933, he had himself designed a *ne plus ultra* monocoque racing car, the Lightweight Special. If a two-man team (Issigonis and his friend George Dowson), with no financial resources beyond the former's small salary from Morris Motors, and working in a garden shed during scanty leisure hours, could make a stressed-skin car which worked, it could hardly be argued, either, that such an undertaking was beyond the means of Daimler-Benz AG.

Issigonis's passion for making most parts of a car fulfill at least two functions originated around 1931, when he was

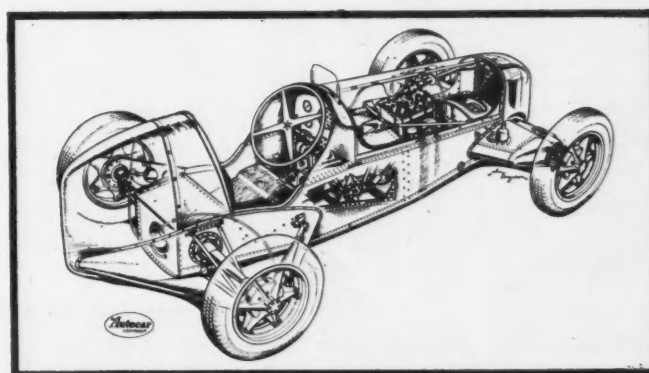
racing a supercharged 750 cc Austin in British sprints and hillclimbs. He partially hidebound the Seven by rigidly tying in the engine compartment sidewalls with the chassis frame. The compound contoured frontal cowling did a secondary chore too, supplying the only anchorage for the heavy blower.

In 1933, by which time the Austin had reached its development peak and, so to speak, toppled off the summit, he embarked on the gigantic labor of love that was to bear fruit in 1939 as the Lightweight Special. Considering its seven-year gestation period, you could have excused it if the car had become obsolete prenatally. In fact, though, when it finally made the starting line it was not merely up to date but out ahead of its time. Describing it in his evergreen book entitled SPECIALS, John Bolster wrote: "It has the appearance of having been built regardless of cost in the racing depart-

THE MOTOR, LONDON



Issigonis throws the pert Lightweight Special through a bend at Prescott Hillclimb, where the car once beat one of the cost-no-object 750 Austins.

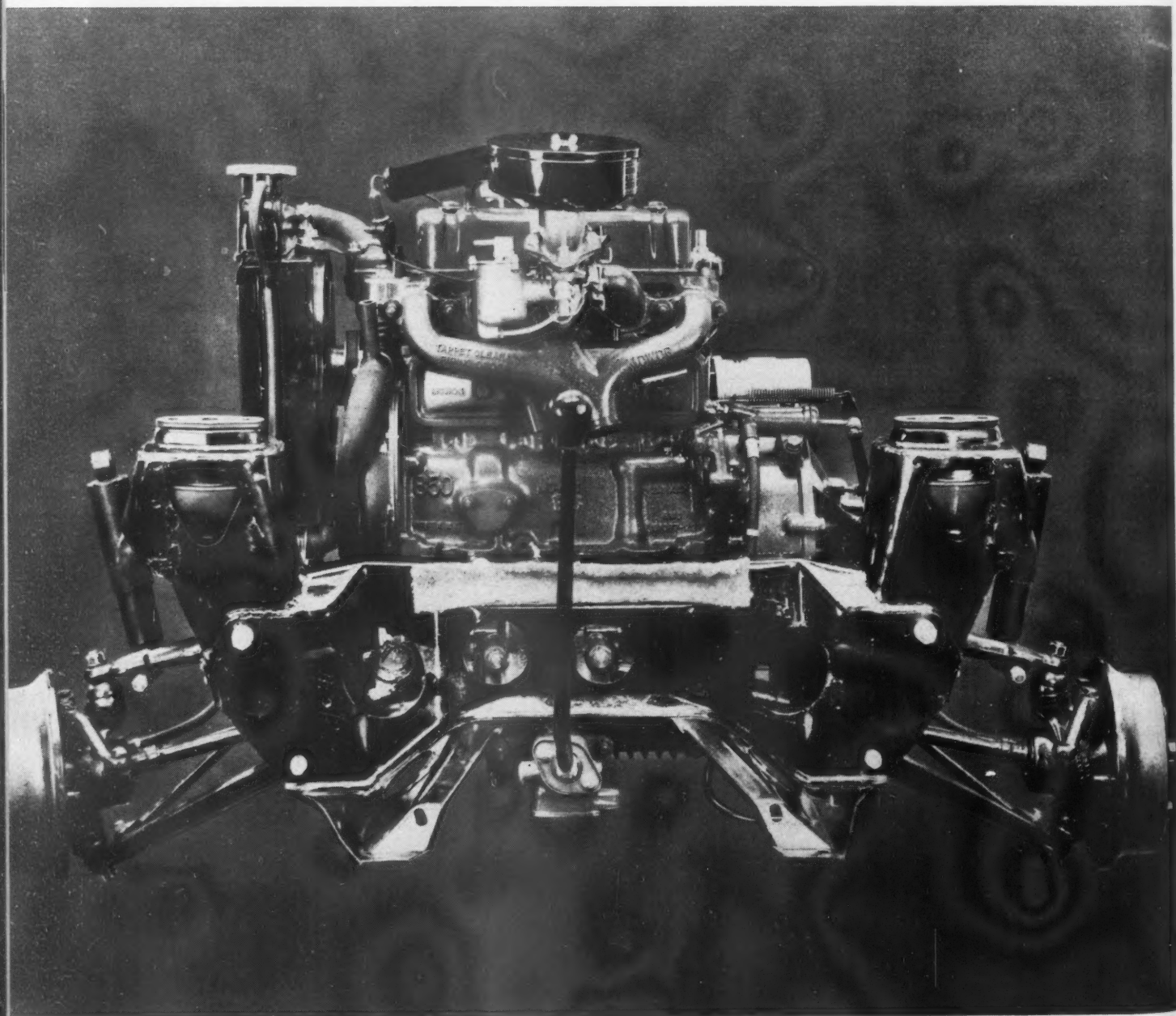


Its stressed-skin construction and neat all-independent suspension made Lightweight advanced for its day. Engine here is early Austin L-head.

ment of a great factory, whereas it is the result of sheer hard labour in a little shed, with no proper equipment whatsoever".

The general-arrangement drawing for the Lightweight took the form of a mural in the tight-fitting garage housing the Issigonis family car at Kenilworth, Warwickshire. This non-portable picture was later to prove an embarrassment to its author because, long before the project's completion, his parents disposed of their Kenilworth home and moved to Oxford, 45 miles away. Committed to plaster rather than paper, the g-a drawing had to be abandoned.

(Continued on page 88)



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Road Research Report: AUSTIN 850



► The British Motor Corporation has just introduced to America a four-passenger sedan that breaks completely with English tradition. The new 850 has front-wheel-drive, fully independent rubber suspension and an integrated engine-transmission mounted East-West in a car parked North-South.

The 10,000 cars allocated for this year will be sold in the U.S.A. by both Austin and Nuffield (Morris and MG) dealers and will be known appropriately as either Austin or Morris 850. The only differences will be minor ones in the grille, though they are actually made in two separate factories. Our test car was an Austin but all remarks are equally applicable to the Morris. To paraphrase a well-known ad, people who are diffident about an Austin can buy a Morris.

SMALLER BUT BIGGER

The 850 is 25% shorter than a VW, which probably makes it the smallest "full-sized" car ever. That's full-sized by European standards, of course, for it's for four passengers. On one occasion we did stuff six adults into the test car, including a hapless GM executive, but fortunately we were only going halfway 'round the block. Another time, traveling four-up on the Long Island Expressway, we all agreed that we had more room for ourselves than four people in a large domestic that stayed alongside for a while. The 850 is incredibly large inside, yet equally small outside. It's in some ways an adult's toy — the kind of car you feel you can park on the sidewalk. Yet for all its fun it's a very real automobile, full of purpose and ability. Its *metier* is urban driving, yet it's quite capable of cruising in the sixties, or even faster.

SECRET F.W.D.

The 850 is delightful to drive. Its steering is quick, light and precise. There is no stickiness whatsoever, and despite the extraordinarily low figure of 1 1/6 turns to full lock, the 850 may easily be steered with one hand grasping the hub. And this with the

front wheels carrying 65% of the load. The rack-and-pinion mechanism does not transmit road reactions, yet always presents an accurate "feel" of the road. We're used to these characteristics in Alec Issigonis's previous design, the long-lived Morris Minor; what astonished us here was his 100% success at masking the front-wheel-drive. We feel quite certain that even enthusiasts would never guess the 850 had f.w.d. from driving it. There is never any steering kick, not even at full lock and full throttle. The response of the 850 to closing of the throttle during a corner is just like that of a well-behaved conventional car. It takes only a modest slackening-off of lock, while the force required at the rim remains nearly steady. On the Test Circle, the 850 was limited by its power to a maximum indicated speed of 45 mph.

SMALL TIRES: GOOD OR BAD?

We did all our cornering and acceleration testing with the 6 extra psi in the tires recommended in the handbook for "fast driving." Normal pressures are 24 and 22 psi, front and rear. With 30/28, we found the ride virtually unchanged while the cornering must be described as incredible. The 850 is low-powered, but even deliberate efforts failed to provoke a side-slip. On wet blacktop, our courage gave out before the tires lost their grip, as we had no intention whatsoever of inverting the machine. Not that it would be easy to, for the 850's center of gravity is very low and the tread is quite wide. The little 5.20 x 10 tires (Dunlop Gold Seal) were developed especially for the 850. When our Contributing Editor in Coventry, Ted Eves, asked for metal-reinforced Durabands for his Mini-Minor, he was refused on the basis that he wouldn't be able to tell the difference! This is high praise indeed, though coming from the tire manufacturers themselves.

There are two common objections to small tires such as these. One is that they wear out quicker since they turn faster; the other is that they get lost inside

big chuck-holes. Considering how tiny they look, their figure of about 1070 revs per mile is not vastly higher than, for example, a 5.20 x 13's figure of 905. Besides, small tires cost less, so on a miles-per-dollar basis the disadvantage isn't so marked.

On this subject, Eves reports an estimated life of some 8000 miles. This sounds excruciatingly low but to grasp its significance one must understand how enthusiasts drive in England. For normal driving, he predicts 15,000 miles. American roads have smoother, less abrasive surfaces, so still higher mileages no doubt can easily be achieved.

As to getting lost in big holes, we can only report that the suspension more than makes up in this respect. Rushing down cobblestone paving and hurtling across just-filled construction ditches on New York City's miserable streets never caught the 850 unprepared. The irregular surfaces could and did make the body rumble but between the rubber suspension and the superb seats, the ride was much more comfortable than most cars of any size.

There are two design routes to a smooth ride. One is to use big soft tires, though this means less definite control. The other is — through engineering sophistication — to have extremely light suspension members compared to the weight of the rest of the car, i.e., a low unsprung/sprung weight ratio. The latter is the path taken by Issigonis, and it is greatly to his credit that he has achieved it at low cost in a very light car.

BIGGER ON THE INSIDE

Fancy names or components do not by themselves make a better car. The engine wasn't set in sideways for the fun of it; it was done that way to save space. The less room needed for the power unit, the more there is left for the people who buy the machine. Of the ten feet of length, only the front two are needed for the "mechanism." The remaining 80% is available for transporting people and their possessions, a figure that takes a lot of beating.

Most "minicars" seriously short-change the people who ride in them. They are usually hard to get in and out of, and there is rarely anything like enough room for husky, corn-fed Americans. For this reason they've never made a permanent dent in the market, not even in Europe where storage and operating space is more at a premium than here. Just as the Volkswagen surprised a lot of people with its unexpected success, so, we think, will the Austin and Morris 850's.

The 850's are much smaller in the flesh than the pictures indicate. Urchins who wonder what they are seem quite satisfied to be told they're grown-up roller skates. The editor of England's *MOTOR SPORT* calls his the Minibric, which has something to do with its size, its shape, and perhaps how it's built.

If we liken the 850 to our compact cars, we can say that it does much the same job as preceding models. In some cases, it does a better job. Compared to the Morris Minor, for instance, the 850's windows are all larger, the seats are higher off the floor and, in front,

farther back from the 15 $\frac{3}{4}$ -inch wheel and actually wider. Its occupants enjoy about 6 inches more elbow room, thanks to the sacrifice of winding windows for two-way sliding ones. Both halves slide and each has a push-button latch to lock it at any of several positions including closed. These latches are held to the glass panes by single attachments. After a very short time they started to pivot about them, making the windows quite difficult to move on their slides.

The very large doors open wide to an opening 34 inches tall. Each front seat has 4 inches of adjustment (the same as on most American cars) and tips forward and up to clear a path to the rear seat. The seats on the test car had the optional foam rubber cushions. The front ones were carried on rubberized straps of the sort that have become popular in the modern furniture business. You seem to sit in rather than on them, and though there's not much vertical travel left after you've sat down, they combine with the suspension to carry you in surprising comfort. Our only complaint was that we would like to have been able to slide the seat back just one more inch or two; after a half-hour or so the chair height seemed to stop providing the much-needed thigh support. Since the adjustment mechanism uses small holes punched in the tubular seat structure, this could probably be improvised easily.

One feature that bothers Mr. Issigonis not a bit is the idea of the steering wheel being at a slight angle to the driver. The Morris Minor is laid out just the same and we must confess that it does seem to be something one gets used to in short order. The wheel is directly in front of the driver and is laid down at something approaching a 45° angle, much like an Indy car or VW Transporter. We like it very much, as you could hold your arms in close gripping the wheel at 4 and 8 o'clock or stretch out to 2 and 10 o'clock to relax your position. A secondary advantage of this flat position is the much greater clearance left between the wheel rim and the seat cushion. Five inches is typical these days (and too close); the 850 has seven.

INSTRUMENTATION AND HEATING

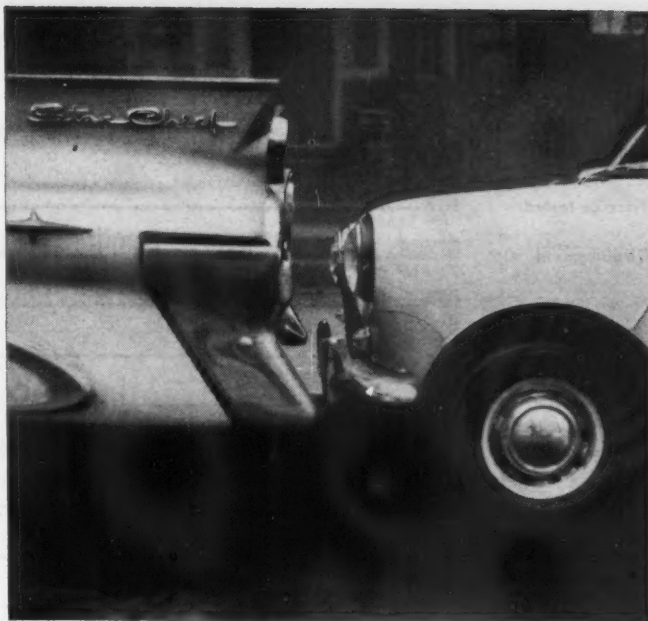
Since British cars have to be set up for both right- and left-hand-drive, it is no surprise to see the instrument cluster in the middle of a full-width parcel shelf. Cluster is a strong word, but at least there is a fuel gauge (for the 6 $\frac{1}{2}$ gallon tank.) Oil pressure and generator warning lights and high beam indicator compete for space around the large, round speedometer dial. The odometer has no tenths and no reset-to-zero feature. On the outside of this cowl are two small tumbler switches and two round bits of plastic that look like lids off something bought in a drugstore. The latter are diffusers for lights which illuminate the long parcel shelf (it's so big, you need them to find things at night). The switches control them and the instrument lighting.

Above is an ashtray, one of three in the car. Below are, left to right, heater blower rheostat, windshield

Text continued on page 80, technical data overleaf



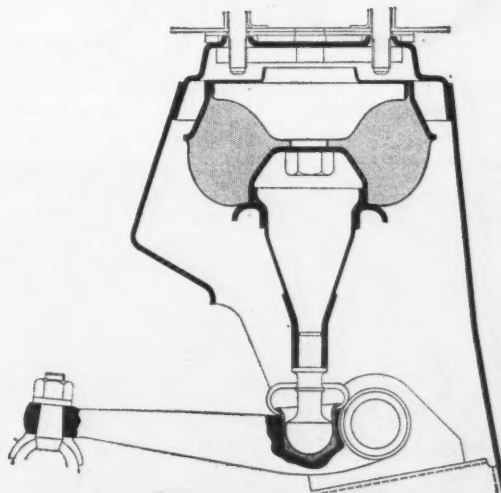
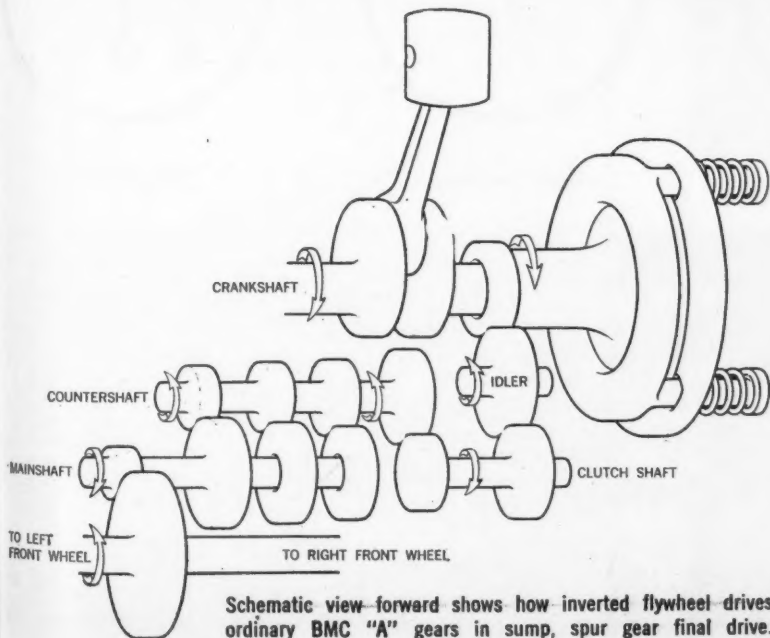
Well-shaped seats turned out to be more comfortable than they look. Gear lever must be lifted forward to third gear; it's not easy.



For an essentially urban car, the 850's weakest point is its too low, too flimsy bumpers. Lenses and grille are exceedingly vulnerable.



How to make parking easier: take four people sitting down, add 20% for mechanism, wrap gently with sheet steel, crimp, weld and add glass.



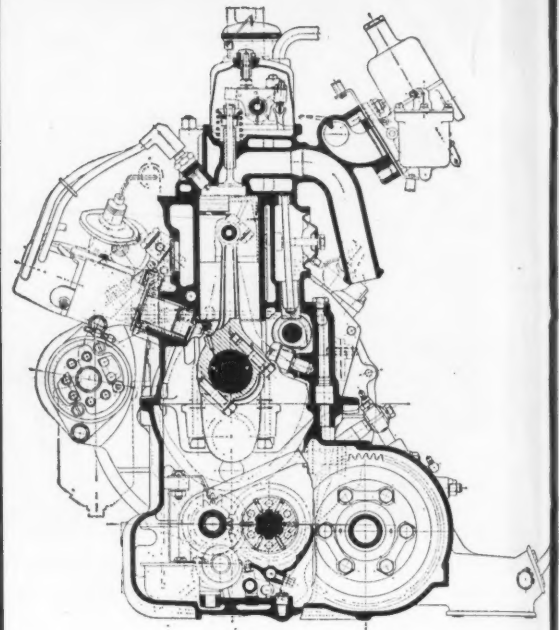
Doughnut-shaped rubber spring is held between two metal cones, squeezed in both compression and shear.

Road Research Report

AUSTIN 850

Price as tested	1000 \$1389	7000
Displacement	20 51.7 cu in	320
Power (SAE)	20 37 bhp	320
Curb Weight	1000 1320 lbs	4000
Swept Braking Area	100 124 sq in	400
Weight on Driving Wheels	35	65%
Wheelbase	70 .80 in	130
Piston Speed, "corrected"	1000 2365 fpm	4000
Speed @ 1000 rpm in Top Gear	10 14.8 mph	25
Mileage	10 34 mpg	40

Importer: Hambro Automotive Corp., 27 West 57th Street, New York 19, N.Y.



ENGINE:

Displacement 51.7 cu in, 848 cc
 Dimensions Four cyl, 2.48 x 2.69 in
 Compression Ratio 8.3 to one
 Power (SAE) 37 bhp @ 5500 rpm
 Torque 44 lb-ft @ 2900 rpm
 Usable rpm Range 800-5500 rpm
 Piston Speed $\div \sqrt{s/b}$ 2365 ft/min
 @ rated power
 Fuel Recommended Premium
 Mileage 28-40 mpg
 Range 180-270 miles

CHASSIS:

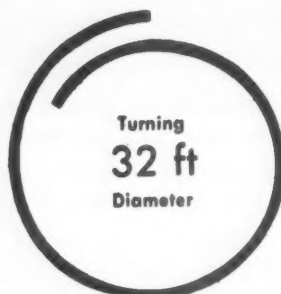
Wheelbase80 in
 Tread, F, R 48, 46 in
 Length 120 in
 Suspension: F, ind., control arms, rubber ring;
 R, ind., trailing arms, rubber ring.
 Turns to Full Lock 1 1/6
 Tire Size 5.20 x 10
 Swept Braking Area—drum 124 sq in
 Curb Weight (full tank) 1320 lbs
 Percentage on Driving Wheels 65%
 Test Weight 1610 lbs

DRIVE TRAIN:

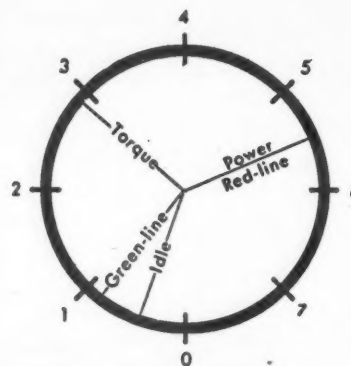
Gear	Syncho?	Ratio	Step	Overall	Mph per 1000 rpm
Rev	No	3.62	—	13.66	
1st	No	3.62		13.66	4.1
2nd	Yes	2.17	67%	8.18	6.9
3rd	Yes	1.41	54%	5.32	10.5
4th	Yes	1.00	41%	3.76	14.8
Final Drive Ratios: 3.76 to one.					



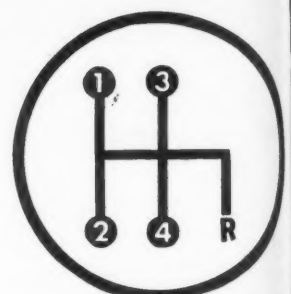
Steering Behavior



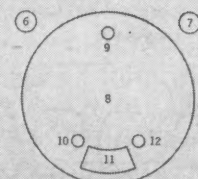
Turns to Full Lock



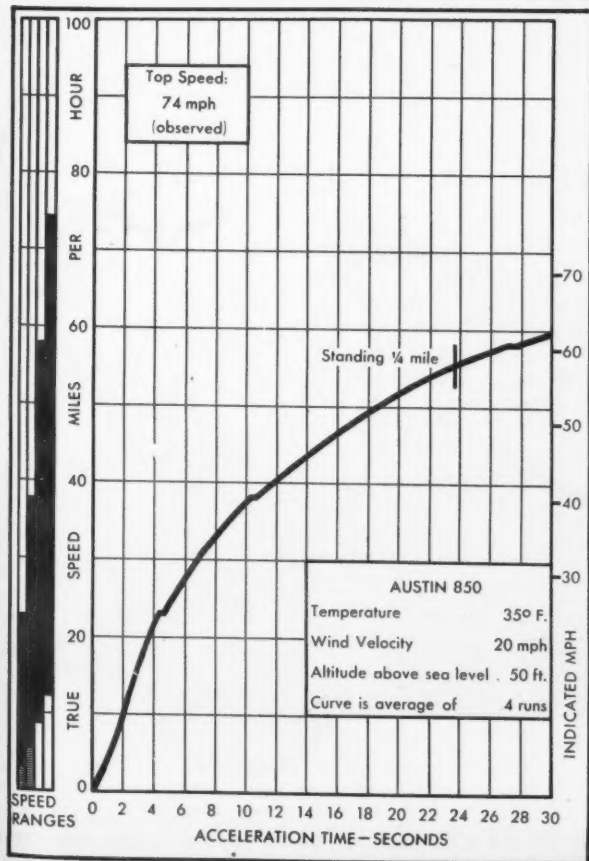
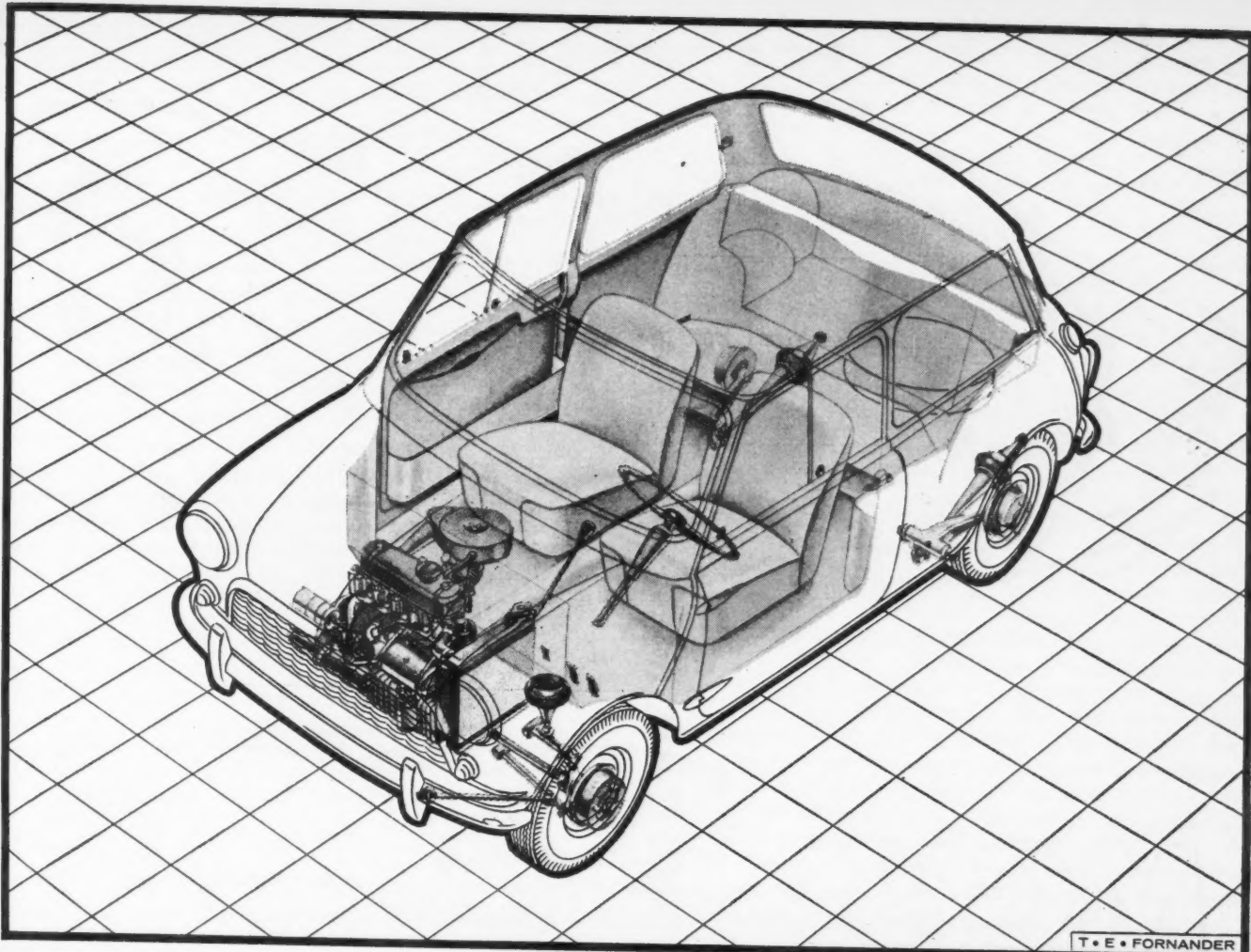
Engine Flexibility

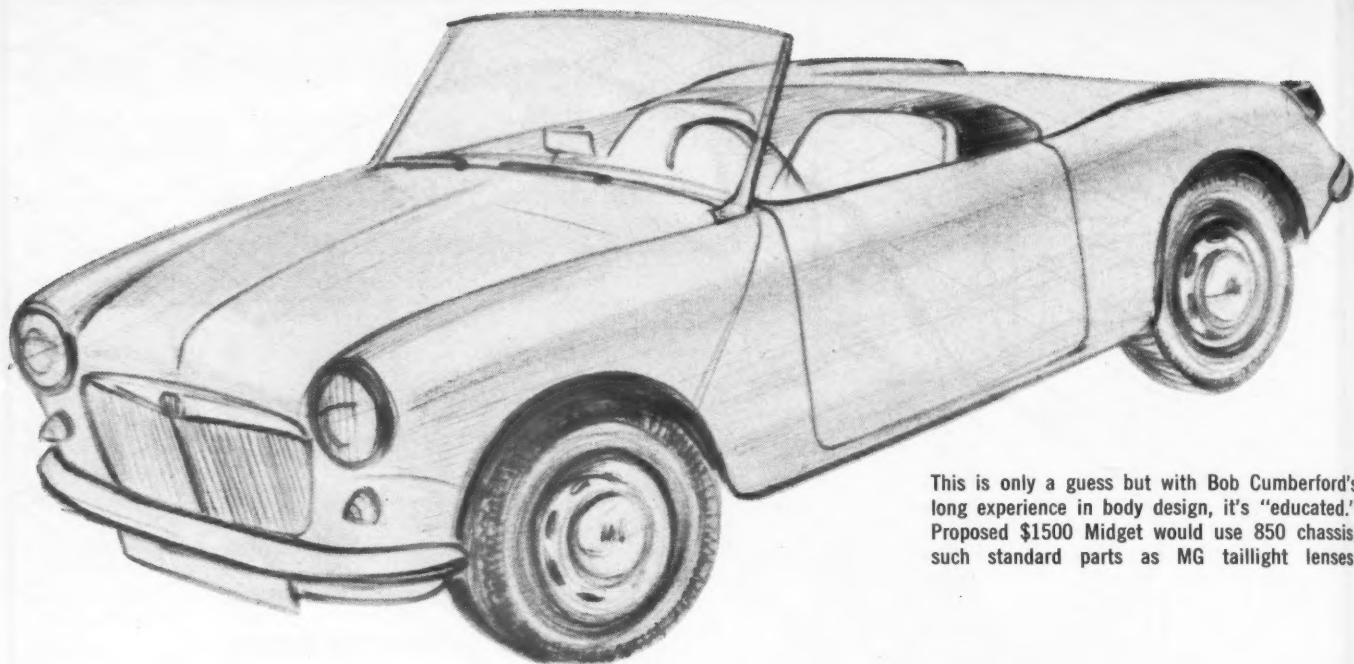


Shift Pattern

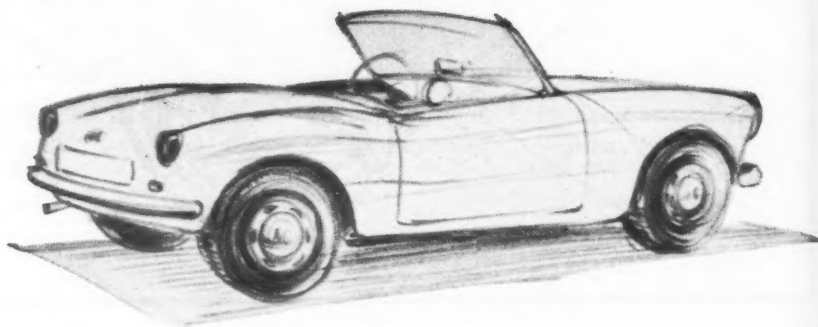


- | | | |
|--------------------|-------------------|------------------|
| 1 Heater | 5 Choke | 9 Beam Indicator |
| 2 Windshield wiper | 6 Dash light | 10 Oil Pressure |
| 3 Ignition | 7 Courtesy lights | 11 Fuel Gauge |
| 4 Headlights | 8 Speedometer | 12 Generator |



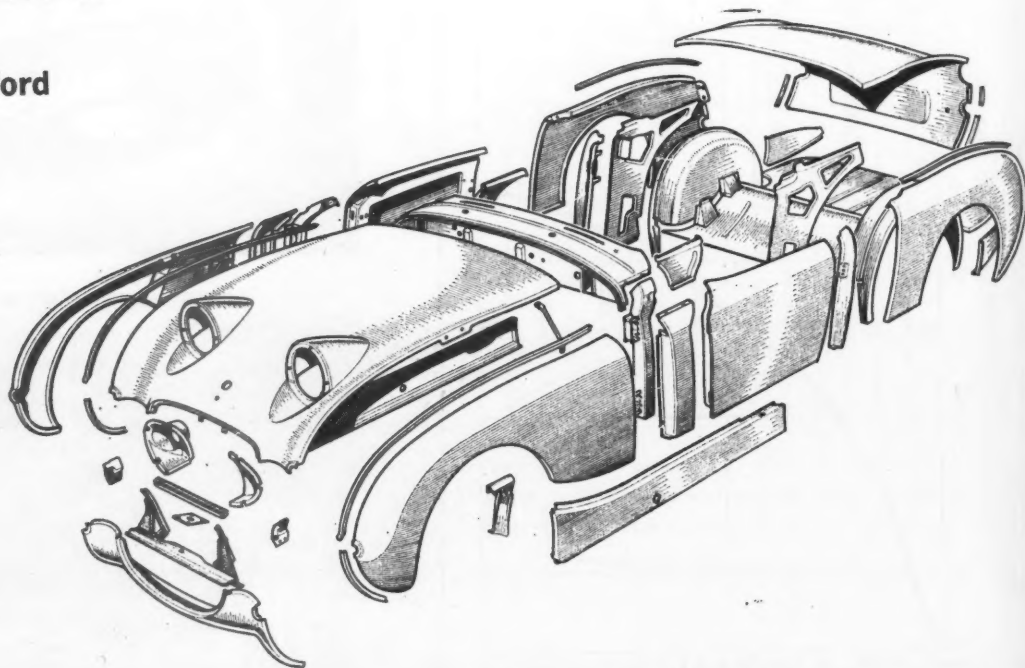


This is only a guess but with Bob Cumberford's long experience in body design, it's "educated." Proposed \$1500 Midget would use 850 chassis, such standard parts as MG taillight lenses.



MG'S NEW MIDGET?

by Bob Cumberford



Austin-Healey Sprite, like 850 and SCI's "could-be" MG Midget, uses integral-body-frame. Midget could use already-amortized 850 chassis, would cost less than \$1795 Sprite.

► Those SCI readers who remember the "TC days" with fond nostalgia would be well-advised to take a long, careful look at the Austin 850 Road Research Report on page 46. According to recent information from England, the BMC minicar is the basis for a new MG Midget now under development at Abingdon-on-Thames. This is exciting news, portending as it does MG's return to pre-eminence through offering the most sports car for the least money. Certainly this has been the goal of the MG Car Company with every model it has made, but it has succeeded best and most often with the Mighty Midgets.

Late in 1948 a favorable rate of exchange between the American dollar and the English pound sterling brought the price of the MG TC down to \$1750 in this country. It was probably the greatest sports car bargain ever seen in the U. S., one that no one expected to see again in an era of inflation and rising prices. When it was announced in 1958 that the Austin-Healey Sprite would be sold here for \$1795, the news came as a pleasant surprise. Indeed, were it not for the fact that Donald Healey was a proven miracle-worker, it's likely that no one would have believed it at all. And now, in an attempt to regain the position usurped by the Sprite, MG intends to offer a modern sports car for even less money. The obvious question is: "How can they do it?" The answer: ingenuity.

Donald Healey used plenty of ingenuity when he designed the Sprite, and in so doing provided some prime object lessons for the "backroom boys" at MG. The most important of these is the dictum "you can't afford a separate chassis frame." The Sprite's body-chassis unit is a sort of ultimately-simple design. Healey has managed to produce a satisfactory unit-construction automobile without the use of fantastically expensive complex stampings. The Sprite is made almost entirely of very small and shallow sheet metal stampings with generous flanges. These are clamped together and spot-welded into a rigid whole. Simple as they are, however, all of these pieces are unique to the Sprite, and the cost of tools for making them had to be amortized through sales of the one model. MG gains a big advantage for the New Midget by using the 850's floor pan stampings.

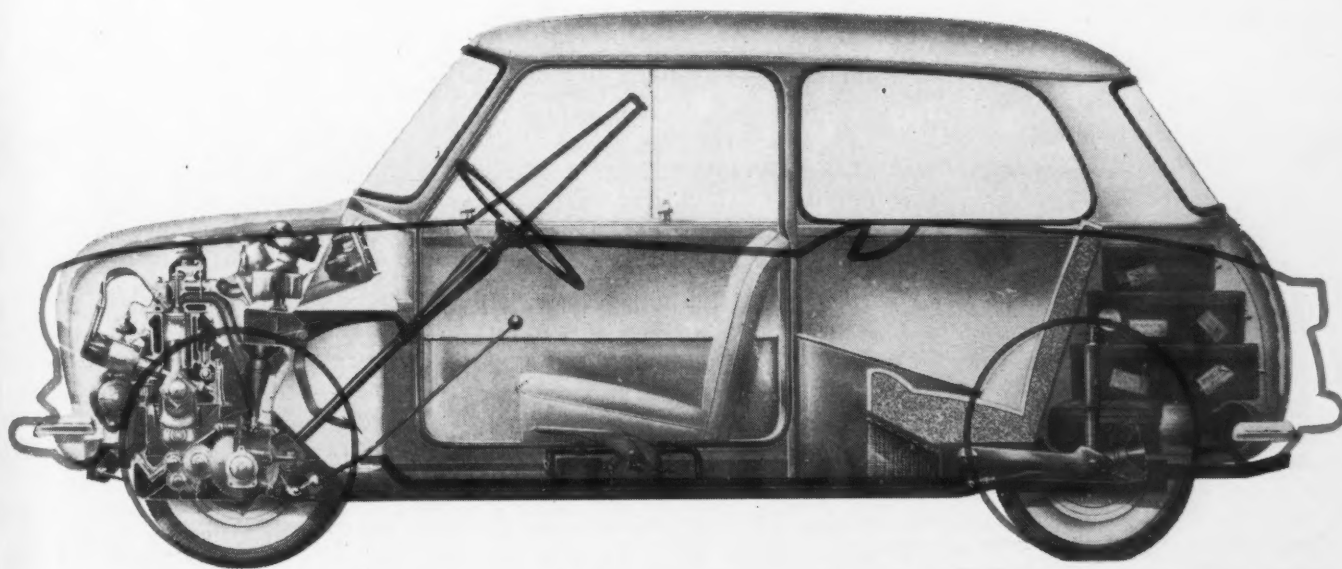
Suspension of the New Midget is taken directly from the 850, so in effect MG gets it "free." Only the mounting of the rubber springing units need be changed to obtain precisely the suspension characteristics desired for a sports two-seater. The MG will use 12-inch wheels and tires for better traction, a necessity with higher power.

Current information indicates that the new MG will be powered by a one-liter version of the BMC A engine, as used in the Morris Minor 1000, Austin A-40, and Austin-Healey Sprite. There is nothing special or expensive about it.

From the foregoing it's apparent that all that will be totally new in the MG New Midget is the body. And it's equally apparent that the body will be the most important factor, after price, in determining how the new car will be received. Given the brilliant engineering of the Morris 850, MG's designers have an unprecedented opportunity to produce a great car, a milestone in the history of the sports car. Will they do it? Unhappily, the answer must be: probably not.

Somehow the advertising-sponsored thesis that low cost and decent appearance are mutually exclusive qualities has gained currency, affecting even those whose past work gives it the lie. Consider the Sprite: it is a fine little car, ingeniously engineered; it is also a ridiculous-looking object, an eyesore, a really ugly car. Donald Healey himself tacitly admits it, as any man of his intelligence, imagination, and demonstrated good taste must: "I am rather sorry that we couldn't do what we had first planned, but it would have taken months' more time, and cost a bit more, to have incorporated retractable lamps." This economic explanation is all the more feeble, coming as it does from the man who, just nine years ago, made one of the best-looking sports cars of all time from cast-off Austin A-90 pieces.

If the corporate bureaucracy of the giant British Motors Corporation can bring as forceful a man as Donald Healey from the A-H 100 to the Sprite in six years, what hope is there that MG designers will preserve any of the flair that characterized the MG TC, designed in 1938 as the TA? Judging from the current MG A, whose shape first appeared at Le Mans in 1951, there is no hope at all. —BC



Take a roofless 850 (Morris, of course), move seat back, lower steering wheel, rearrange shift linkage, level the intake manifold, cast a valve cover with lowered filler cap, use 12-inch wheels and you'll find yourself ready to drape this splendid chassis with an eye-catching body. How about it, BMC?

SCI's Jesse Alexander brings you the full story on one of Grand Prix racing's "back-room boys", who served his apprenticeship with Ferrari and Maserati and is now Chief Designer to Stirling Moss.

► A few years ago Valerio Colotti was no better known than any of his colleagues in the drawing office at Officine Maserati, but today his name is familiar throughout the world of motorsport. No doubt when a definitive history of the current racing era is written, Colotti's name will be listed with equally famous men: Lampredi, Alfieri, Chapman, Cooper, and Mundy, as contributors to today's design trends.

To find out a bit more about the little man with the friendly smile (he's indeed little, bearing witness to the stereotyped Italian male) we visited Colotti's studio in Modena. Obviously fearing that I would never find it without help, he picked me up at my hotel in his Fiat 600. We cautiously motored our way through back streets, finally stopping in front of an ancient building in which he rents space. Up an old stone staircase, down several hallways, through a pair of unmarked doors, I was led into a huge studio. A large desk in the corner and two drafting boards took up most of the space. Overhead, in complete contrast to the perfection produced below it, hung a chandelier that appeared to have endured the bombing of Monte Cassino — in its jumble of twisted wire and dazed-looking naked bulbs. At Colotti's suggestion — for it was an extra severe winter day in Modena, with a half-meter of snow on the ground — we kept our overcoats on. Colotti opened the shutters and asked me what I wanted to know.

Valerio's ancestry is pure Modenese. As he himself says, and with a certain amount of pride, "I speak three languages: Italian, French and Modenese," referring to the dialect spoken in and around the city of Modena. Born in April of 1925, he attended local schools, completing his education at the local technical college. Finding a position wasn't easy shortly after the war but the barber who lived above the Colotti family thought he could help since one of his customers was Enzo Ferrari. The barber said to Valerio one evening, "Listen, why don't you try for a job at the Ferrari factory in Maranello? Perhaps you would like building race cars, and I can speak to Ferrari in person."

And so it was that Colotti shortly found himself among surroundings which 'til then had been remotest from his mind. He had seen several races run through the streets of Modena but he'd never felt a passion to work with racing cars. At that time Aurelio Lampredi, *Capo Ufficio* at Maranello, quickly sized Colotti up and put him in charge of chassis design.

One of the first projects to come across his desk was the design of the initial Ferrari de Dion rear axle. This was fitted to the Formula 1 car of that era, and then was followed by the Formula 2 two-liter car, made famous by Alberto Ascari. Colotti was responsible for the chassis and suspension while Lampredi designed the power units. All in all Colotti spent five years at Maranello before leaving to go to work for Maserati.

Arriving at Maserati in 1953, he was quickly put to work revising the *monoposto*. This produced the well-known 250F car, with a considerably lighter frame and with gearbox and differential in unit at the rear. Not only the de Dion layout but also the efficient 250F drum brakes came off Colotti's board. Then came a series of famous sports cars. Colotti designed the suspension, transmission and chassis for the 300S, the 150S, and the famous 450S, all powered by engines designed by Engineer Alfieri. Director Orsi called upon Colotti to lay out the chassis for the 3.5 Grand Touring Maserati and just before Valerio left,

when Maserati fortunes were in a state of flux, he designed a transmission for the well-known El Dorado single-seater which Stirling Moss drove in the 1958 Monza 500.

A decision to open his own design office was hurried upon him by the retirement of Maserati from racing at the end of 1957. As soon as Colotti's shingle was out, the first person to come calling was Alf Francis, Stirling Moss's mechanic. Alf and Colotti are, of course, old friends from the 250F days at Maserati. Alf speaks near-perfect Italian, even learning some Modenese from Colotti, while Valerio has had no time to study English. His Anglo-Saxon vocabulary is limited to such words as "ball race, half-shaft, gearbox and chassis." Alf Francis told Colotti about the requirements of Rob Walker, who had just obtained a B.R.M. engine to fit into a Cooper chassis and who wanted Colotti to design a new five-speed transmission for the car. Since then, Valerio has been busier than he ever expected. To date, completed projects include the five-speed Walker transmission, a five-speed gearbox for de Tomaso's 750 cc car and the entire Behra Formula 2 Porsche, for which Colotti designed a chassis and supervised the car's construction as well.

Lately, several projects have been under way, including a new transmission for the 1960 Vanwall and a four-speed gearbox for the WRE sports-racing car. Formula Junior will feel Colotti's influence in 1960, for he has recently designed a five-speed transmission to fit into standard Fiat and VW cases. Very recently Colotti has been asked to design a complete Formula Junior car with specifications calling for a DKW powerplant.

All this has not given him as much time with his wife and family as he would like. On top of his design work, Colotti teaches fifteen hours a week at Modena's *Citta di Ragazzi*, a kind of local boy's town.

Colotti's developments are not radical. It's not that they couldn't be, but cost has always been one of the determining factors. His designs are orthodox yet technically beautiful in their emphasis on lightness and strength. Light alloys are used wherever practicable. Engineering principles learned in school, then tested in the ten years at Ferrari and Maserati, have given Colotti a suitable background for his present work.

His specialty is, of course, transmissions, and his most recent "baby" is a new five-speed gearbox for Rob Walker's 1960 car. Convinced that last year's unit wasn't up to the demands of Stirling Moss's driving, Colotti has strengthened his transmission noticeably, with changes in bearing sizes, transfer gear design and in the lubrication system. Disc brakes have been moved inboard at the rear. Far from impressed with the standard Cooper chassis, Colotti designed an all-new frame for Rob Walker, and he spent some time in England working with Alf Francis on construction of the Walker-Climax.

Colotti enjoys his current work tremendously — especially designing a car for Moss, whom he considers to be the best driver available today. Designing for Moss requires thorough study so that all conceivable weak points can be eliminated — points that wouldn't be critical in the hands of any other driver, not able to drive as hard and fast to win. Colotti also notes that since Moss doesn't have to foot the bill for broken gearboxes, he is far from inclined to spare them. This too is fortunate, says Colotti, for once his equipment has worked for Moss, he can honestly say that it is the best that can be constructed. Colotti hopes to be able to say this at the end of the 1960 season.

—JLA

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JLA

COLOTTI

STUDIO TECNICO
INDUSTRIAL

► On to the races. If you're going to drive your car to all of them, unless you are one of the hardy types who doesn't mind the disheveled look that results from sleeping in your car for a couple of nights straight, you must make hotel reservations in advance. Such races as Le Mans have for years brought "full-up" signs to every hotel, *pension* and even farmhouse in a 60-mile radius of the city, and from an accommodation standpoint, Spa, Zandvoort and Nürburgring are in the wilds. Never forget that, at race venues and elsewhere, your American compatriots now constitute a horde whose annual descent on Europe makes the Mongolian invasions mere skirmishes by comparison.

Keep in mind that automobile racing is an important sport in Europe so that most travel agencies are likely to know what major racing events are in the offing and can make transportation, hotel, local car-rental and reserved-seat reservations for you. In most countries of Europe, there are usually very-low-fare special trains from major cities to big races. For example, British Railways runs a special train from London to Silverstone, leaving early race-day morning and returning the same evening, round-trip fare and admission to the race (though no reserved seats, which can be bought at the track) for adults costing less than \$3.

If you happen to be in London at the time you decide to go to a Grand Prix or major sports car race on the Continent, you will find a very special and amazingly inexpensive charter tour available for every major event. Originally for members of a British car club, these arrangements are now being handled by the R.A.C. Travel Service, Ltd., 66 Haymarket, London, S.W. 1, and the fact that the charters are now sponsored by the Royal Automobile Club opens them to any R.A.C. member or affiliate member — which means that if you have belonged for more than six months to the A.A.A. in America (or any R.A.C.-affiliated British car club, of course), you or any American travel agency can make reservations on these first-class charter planes.

There are 36 R.A.C. Charter Flights to 21 major races, most of them leaving London two or three days before race day and flying directly to the airfield nearest the circuit. Drivers, crewmen and car owners have been using these charters for the past several years, so one's odds of riding with Moss, Brabham, McLaren, Rob Walker, David Brown or Colin Chapman are quite good. For some events, such as the Belgian, French and Dutch G.P.'s, one can return to London the same day, and for others, both day-return and three- or four-day trips are available. The first-class fares are approximately 40 percent cheaper than tourist-class rates on scheduled airlines (presuming any scheduled flight comes anywhere near the track). Round-trip fares range from around \$28 for the French, Belgian and Dutch Grands Prix or the Paris Automobile Show (one to four days) to a top price of approximately \$110 for the Portuguese (at Lisbon) or Syracuse (Sicily) *Grandes Epreuves* and \$124 for the Morocco race in Casablanca. The planes used — DC-3's, DC-4's, DB-6B's, Britannias and 68-passenger pressurized Hermes — are also

first-class, being rented generally from Silver Cities Airways, a large British commercial airline. The R.A.C. Travel Service will also arrange good motel or hotel accommodations convenient to each track and rental cars and tickets for the races, if requested. Rates for these are as reasonable, comparably, as the air fares. The complications this specialized service saves would seem to make it invaluable, not to mention the enormous saving in plane fare.

For a race fan who has never been to European races before, who has no "connections" who can get him into the pits and garages, who doesn't particularly relish the semi-isolated kind of first-time trip alone (or with wife) to a strange track where one's lack of languages other than English and general unfamiliarity tend to put one in the role of American Tourist Clod, there exists the European Race Tour headed up by one Joseph E. "Dusty" Mahon. Of course, on Mahon's tour, to some people you may simply appear to be a different sort of clod — one of the flock of eager American race fans who traditionally trudge along behind safari-leader Mahon like so many curious geese — but you'll have a whale of a lot of fun and you'll be wide-eyed for good reason. Mahon, owner of the Westwood Travel Agency (1133 Glendon Ave., Los Angeles 24) has been escorting a Grand Prix tour to Europe for years and it's pretty hard to find anyone who could do a better job.

Mahon's brood of 15 or 20 people pay \$990 each to leave New York June 14th for the Belgian G.P. at Spa, go from there to the Le Mans 24-Hour race the next weekend (Mahon has solved the terrible Le Mans reservation problem by taking an entire small hotel for his group), then to the French G.P. at Rheims, and ending up the tour in Aintree for the British G.P. Because Dusty is so well-known and well-liked by race people, he prestidigitates his whole crowd into the barred-to-the-public garages and paddock areas not infrequently. Besides the four races, those on Mahon's tour are provided with an incredible variety of other things to do: visits to eight automobile factories, ranging from an entire day at Mercedes-Benz to a three-hour lunch and one-hour plant tour of the Bugatti works in Molsheim; stops at famous automobile museums, including Lord Montagu's new one in England; night-clubbing, sight-seeing, a famous vintage car race in England and membership to the Steering Wheel Club in London.

The \$990 does not include the cost of a car (if you're not buying a car to bring back, Mahon recommends renting a VW), but does include round-trip, economy-class air fare from New York on Sabena Airlines, first-class hotels (in the cities that have them), two meals a day and reserved seats at all the races. Dusty says that his people "... have a lot of free time if they want it..." which very well may be true as the caravan averages around 100 miles a day on the road. But apparently it is one long, happy party, which won't surprise you once you meet Mahon, a well-informed, warm, lusty and delightful man — obviously one of that rare breed of born guides.

(Continued on page 84)

TO EUROPE'S RACES IN STYLE

by D. M. Bartley



FIRST

BY COMPARISON*



* WHEN COMPARING CARS IN THE \$1,600 PRICE RANGE, REMEMBER—

SAAB gives you \$200-\$300 more in equipment¹

SAAB is 10 years ahead with front-wheel-drive²

SAAB has more leg-room, head-room, door room³

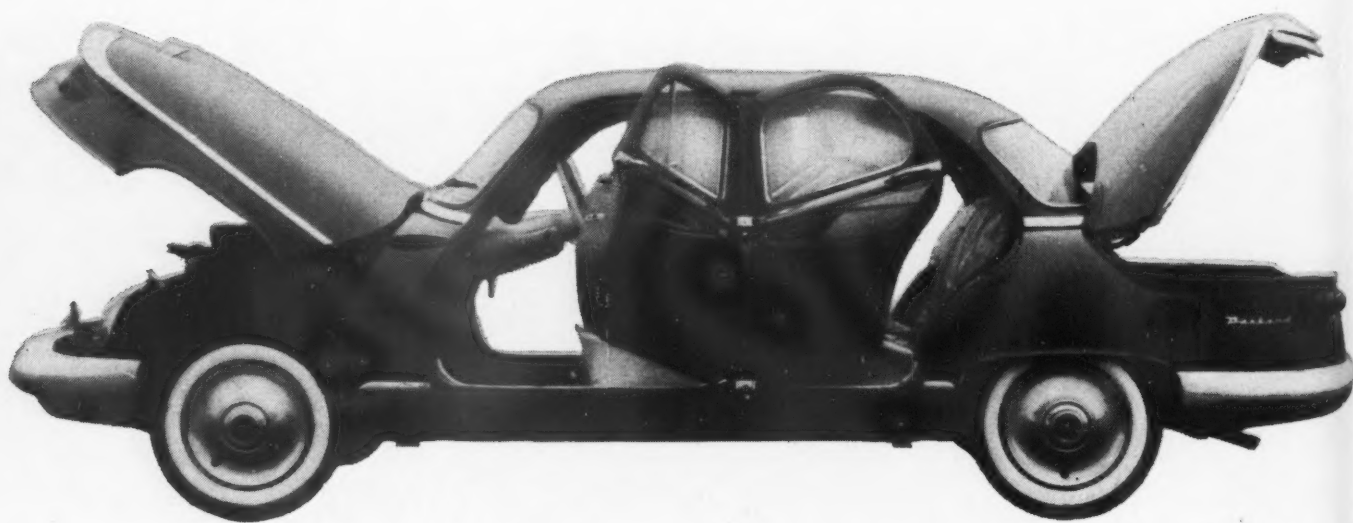
SAAB outperforms everything in its class⁴

BUILT BY SWEDEN'S LEADING AIRCRAFT COMPANY

1. SAAB's complete price of \$1,895 (East Coast, p.o.e.) includes twelve items of highly desirable equipment which cost extra in other cars. 2. SAAB introduced its front-wheel-drive in 1949, thereby gaining tremendous lead-time over cars adopting this superior propulsion system in the future. 3. In a SAAB the driver's leg-room is 47" (with special seat track), head-room 37", and door-width 42½". It's the only small car for BIG men! 4. SAAB has led the 750 c.c. Class for years in worldwide competitions. For full information and directory of dealers contact Saab Motors Inc., 405 Park Avenue, New York 22.

**FRONT WHEEL DRIVE
THE HANDLING TEST
AND THE
PANHARD PL 17**

by Stephen F. Wilder



Access to the trunk and engine compartment is more than ample. Doors, opening out and up, make it a little difficult to disembark gracefully. Smooth shape (at top) increases PL 17's top speed.

► The French Panhard PL 17 four-door sedan provides the basis for the D.B. sports coupe tested in SCI, December '59, but what a different car this is. Its internal dimensions are such that it's being advertised as a compact car rather than a "little", "small" or "economy" one. It has extraordinary spaciousness for a car with only 52 cubic inches (850 cc) to propel it, yet its light weight and reasonable aerodynamic form give it fair performance and impressive economy. You really can put six people and lots of luggage in it or, alternatively, fold or remove the rear seat and have three people and a station-wagon-like cargo deck.

The reason for the body's astounding "volumetric efficiency" is the use of front-wheel drive. Like a rear-engine layout, f.w.d. permits an uninterrupted flat floor between the power unit and the trunk. This is fully exploited by the Panhard design, more so than any similar car or any rear-engine car we can think of.

FRONT-WHEEL DRIVE

There are conventional automobiles and unconventional ones. The conventional ones put the engine at the opposite end from the driving wheels. The unconventional ones unite them at one end and are classified rear-engined or front-wheel drive accordingly.

Front-wheel drive is far from new. Its first application was "a driven front wheel" on Monsieur Cugnot's steam carriage back in 1770. F.w.d. has been with us ever since, though it still has not earned the epithet "conventional." There are a long string of advantages and disadvantages that can be credited to and blamed on f.w.d. The primary difficulty is successfully combining in one pair of wheels the separate functions of steering and driving. The operative word is "successfully." To achieve it, we have had to wait for engineering sophistication to catch up with consumer demands. It has been far easier to obtain reliability and other mechanical graces in conventional layouts where each function has its own device.

While "conventional cars" may be made with the final drive casing bouncing up and down with the rear wheels, one can hardly expect satisfaction with an engine/transmission that does this at the front. It is necessary to have universal joints in the drive shafts to the wheels; at the inboard end so that the engine can remain still while the wheels bounce, and at the outer end so that the wheels can be steered as well. Now universal joints are quite common, being fitted to all propeller shafts on at least one end, but the common types have one failing. If the input is of constant velocity, the output is not, in terms of individual revolutions. By how much is a function of how big a bend the U-joint is making. We're never bothered by this on conventional cars because the bend is so small. But f.w.d. cars must have the same vertical deflections at the wheels as conventional cars, yet their shafts are much shorter and therefore the U-joint angularity is much greater. This poses a serious problem. The answer is "constant velocity" U-joints. Two ordinary U-joints placed back to back will cancel each other's unevenness if the adjacent pivots are parallel. Such double U-joints are an inexpensive manner of solving the problem. There are also more compact ways such as the Rzeppa and Bendix "homokinetic" couplings but they cost more.

There are two basic decisions to make in laying out an f.w.d. design: Shall the engine be in front of the wheels or in back? Shall the gearbox be between the final drive and engine (as in a "conventional" car) or beyond the final drive (as in the usual rear-engine layout)? There are thus four possible layouts, all of which have been used. Assuming the front of the car is to the left, they are: E-G-FD (Panhard), E-FD-G (Saab, DKW), G-FD-E (Citroën) and FD-G-E (Cord). The new Austin/Morris 850 uses a transverse engine in this variation of the Panhard's scheme: $\frac{E}{G}$ -FD.

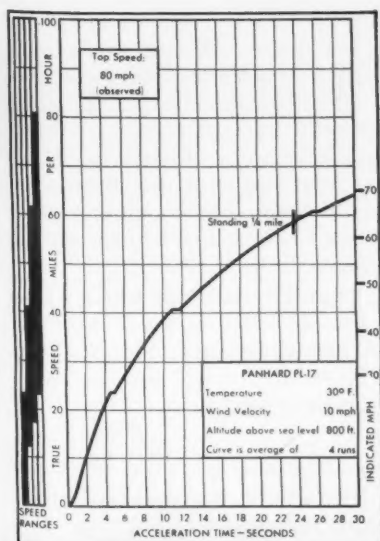
(Continued on following page)

ROAD TEST

PANHARD PL 17 "Seine"

Price as tested: \$1880

Importer: Vendome Motors Corporation
120 East 56th Street
New York 22, N. Y.



ENGINE:

Displacement 52 cu in, 851 cc
Dimensions Two cyl, 3.35 x 2.95 in
Compression Ratio 7.25 to one
Power (SAE) 50 bhp @ 5300 rpm
Torque 50 lb-ft @ 2250 rpm
Usable rpm Range 1500-5400 rpm
Piston Speed $\div \sqrt{s/b}$
@ rated power 2775 ft/min
Fuel Recommended Regular
Mileage 27-30 mpg
Range 310-340 miles

CHASSIS:

Wheelbase 101 in
Tread, F,R 51 in
Length 180 in
Suspension: F, ind., two transverse leaf springs; R, rigid V-axle, six torsion bars.
Turns to Full Lock 1 1/6
Tire Size 145 x 380 (mm)
Swept Braking Area-drum 162 sq in
Curb Weight (full tank) 1880 lbs
Percentage on Driving Wheels 55%
Test Weight 2170 lbs

DRIVE TRAIN:

Gear	Synchro?	Ratio	Step	Overall	Mph per 1000 rpm
Rev	No	2.92	—	17.95	3.8
1st	No	2.68	80%	16.50	4.2
2nd	Yes	1.49	49%	9.16	7.5
3rd	Yes	1.00	30%	6.15	11.2
4th	Yes	0.77		4.71	14.6
Final Drive Ratio: 6.15 to one.					



F.W.D. DRAWBACKS

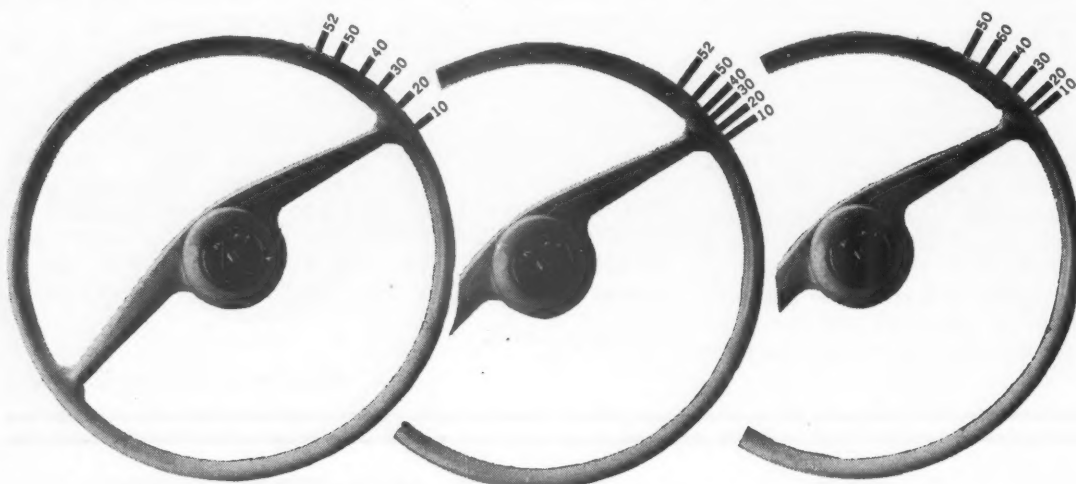
Some of the most famous disadvantages of f.w.d are more traditional than actual, solutions already having been developed by one or more manufacturers. Here is the usual list and how the Panhard stacks up on these points:

"The steering lock is limited by the universal joints' angularity." True, but the Panhard has a 35½ foot turning diameter between curbs. Even though the owner's manual claims a mere 33 feet, that is still better than any American compact. In addition, braking torque reactions must be supplied by the front suspension without interfering with sharp turning. Quite a few f.w.d. cars use inboard brakes so that the universally-jointed drive shaft carries both the braking and driving loads. The Panhard doesn't use this idea. Instead the two transverse leaf springs (upper and lower) are relied on to be lots stiffer fore-and-aft than they are up-and-down. This looks very crude, but it works here just as it does in conventional rear suspensions. We never noticed wheel judder during braking and we observed that the front wheels would lock first with only two people aboard.

"Expensive constant-velocity U-joints are required to

turn out to be an extravagant waste of tire tread. Even on the Panhard, fierce clutch engagement coupled with high revs could break loose the front tires (19 psi). The squeal sounded impressive for an economy car, but it gives the phrase "burning rubber" an unusual connotation as the acceleration is hardly neck-snapping. If Ford does come out with full-size f.w.d. cars, even limited-slip differentials may not cope with the problem there. As f.w.d. cars go, the Panhard has rather little weight (57% with no passenger and no gas) on the driving wheels, others ranging up to 65%. But when we tried to get stuck on a muddy slope, we found it in no way inferior to conventional cars, and a good deal better than some rear-engined ones, since we could steer our power where we wanted it.

"Handling is strongly affected by throttle opening." Tires which are braking or "thrusting" develop less side force at a given slip angle. In f.w.d. this contributes some throttle-on understeer. If you close the throttle, the front wheels develop more bite and sharpen up your turn, sometimes drastically. On the other hand, opening the throttle wide requires more helm to avoid running wide. Tire pressures and sus-



Tire pressures, F/R:19/24 psi24/24 psi24/30 psi

On SCI's Test Circle, the Panhard PL 17 shows quick steering and mild understeer with recommended tire pressures (left). Increasing only front pressures sharply reduced understeer (center graph). Increasing rear pressures in proportion gave back some understeer, but added the fillip of final oversteer (right). The speed would then read up to 60, but less lock was required than at 50 mph.

avoid steering 'kick' in tight turns or on bumpy roads." The statement is true but the Panhard does have c-v joints. As to being expensive, well, it's a matter of degree. Like the Citroën, Panhard uses a pair of Hooke-type joints back-to-back for the outboard U-joint. Like many if not all other f.w.d. cars, it uses ordinary joints inboard where the angularity is less. Splined couplings are used on the shafts; these are extraordinarily large, which indicates that they have used bonded rubber to absorb any remaining traces of steering kick by building in some torsional flexibility.

"The engine intrudes in the cockpit." This certainly can be said of the early Cord or any other f.w.d. car that uses a long engine, but not for the Panhard, which has a short, two-cylinder opposed engine. It is located in front of the gearbox as on the Saab and DKW. The entire space between the wheel arches is filled with the drive train so the cockpit is farther back than it would be on a rear-engined car. As a result, the floorboards are extremely wide and uninterrupted by any power bulges at all. The back seat is also well to the rear but it's still well within the wheelbase.

"In accidents, the engine is vulnerable." This applies equally well to any other front-engined car, especially since engines are generally so far forward now. The Panhard's aluminum bumper sweeps well ahead of the engine at the car's center so there is considerable "collapsible" sheet metal before the engine is reached.

"Traction is lost due to rearward load transfer during acceleration or hillclimbing." For rear-drive cars this is a benefit but not for f.w.d. However, it's not much of a loss except on very powerful cars where initial wheelspin could

pension geometry can be selected to minimize these phenomena. In the Panhard's case, the factory recommends 25 to 50% more pressure in the rear tires (even though they carry only 43-46% of the weight when the back seat is empty). The statement given is true of the Panhard only if you omit the word "strongly."

"F.w.d. requires a very special driving technique." This is the kind of statement with which competitors try to frighten off prospective buyers of f.w.d. cars. It's unfair because it's important only when you're cornering very rapidly indeed. How many buyers of compact or economy cars ever corner in Fangio fashion? The trick of course is that since the driving wheels are also steered, one's steering movements must be matched with one's accelerator movements. Whatever you do with one affects what you want the other to do. In effect, just as the successful f.w.d. design requires engineering sophistication, so does f.w.d. racing require driving sophistication to be successful.

We will return to f.w.d. handling later but first it's only fair to counter the long list of "disadvantages" with the traditional advantages and investigate them too. To keep you impatient, we'll save "faster cornering" for the last.

F.W.D. ADVANTAGES

"Having no driveshaft, the f.w.d. car can have a big wide flat floor." This is equally true for the rear-engined car but the Panhard exploits the possibilities extraordinarily well, being Corvair-sized inside (though taller).

"With its très simple rear axle, f.w.d. cars can have a huge

(Continued on page 93)



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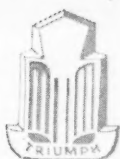


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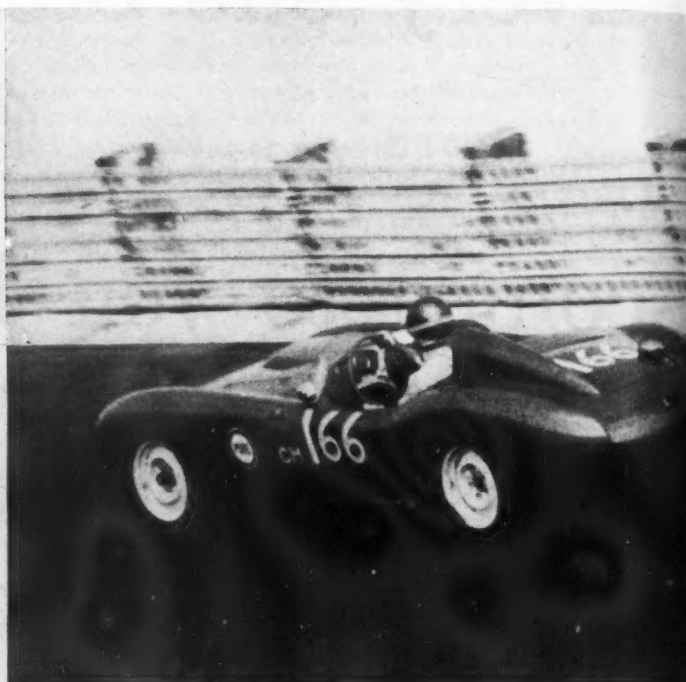
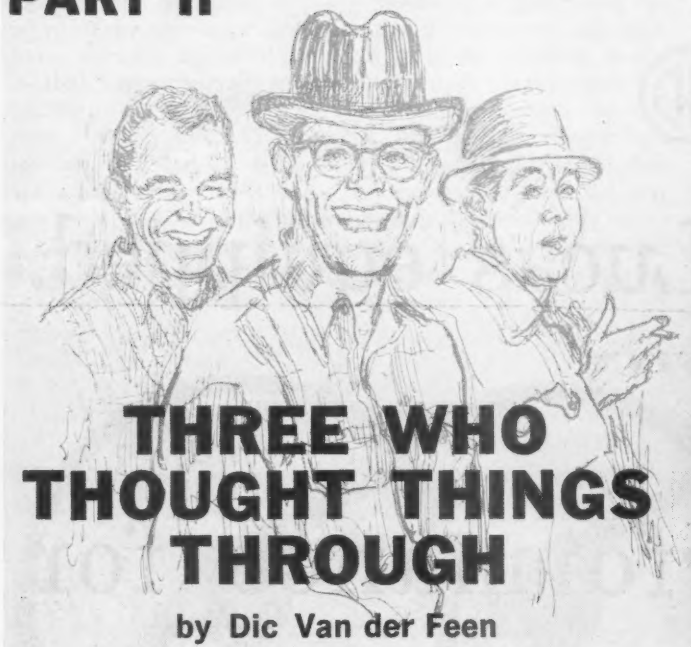
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At Meadowdale last year the most myopic followers of the sport took notice as the

PART II



► On a pale, chilly morning in April, 1958 a two-seater sports car was wheeled from a garage on the outskirts of Hibbing, Minnesota, a town far enough north to call Tacoma, Duluth, and Quebec "south." It was the first time an Echidna had smelled fresh air and, of course, it was the first Echidna. Its builder, Ed Grierson, its sponsor, John Staver, and their co-conspirator, Bill Larson, tried it out up and down the straight, rough rural road. They remember now that the acceleration scared them half to death.

It's creators—each of the trio qualifies as a builder/owner/driver—approached the design of the first Echidna almost as if no one had ever built a racing/sports-racing car before. They dutifully read all the books, papers, and articles dealing with the subject and dutifully filed all they read. Then they went ahead and built their car, examining—and often rejecting—every "truth" and convention they encountered. Their approach might be called pure to the point of primeval.

Those responsible for the Echidna project believe that for a big-car design—let's say a Corvette-powered design, in this country—to obtain a dry weight of under 1900 pounds means either enormous expense, an inherent weakness, or an easy gift for lying. The whole point of the Echidna project is the avoidance of expense. And the proof of the Echidna success lies largely in its durability—a reflection of design strength.

The strength of the design represented in the often unconventional but soundly engineered choices for Echidna frame, suspension, wheels, and steering was examined in Part One of this article. The weight of the complete chassis with wheels, running gear and *all* body and component brackets but without engine, gearbox, drive shaft, radiator, and body is 975 pounds.

It should also be obvious by now that the weight of the Echidna argument toward building a winning racing/sports-racing car is its extraordinary simplicity. Here is a design whose performance can be mentioned in the same

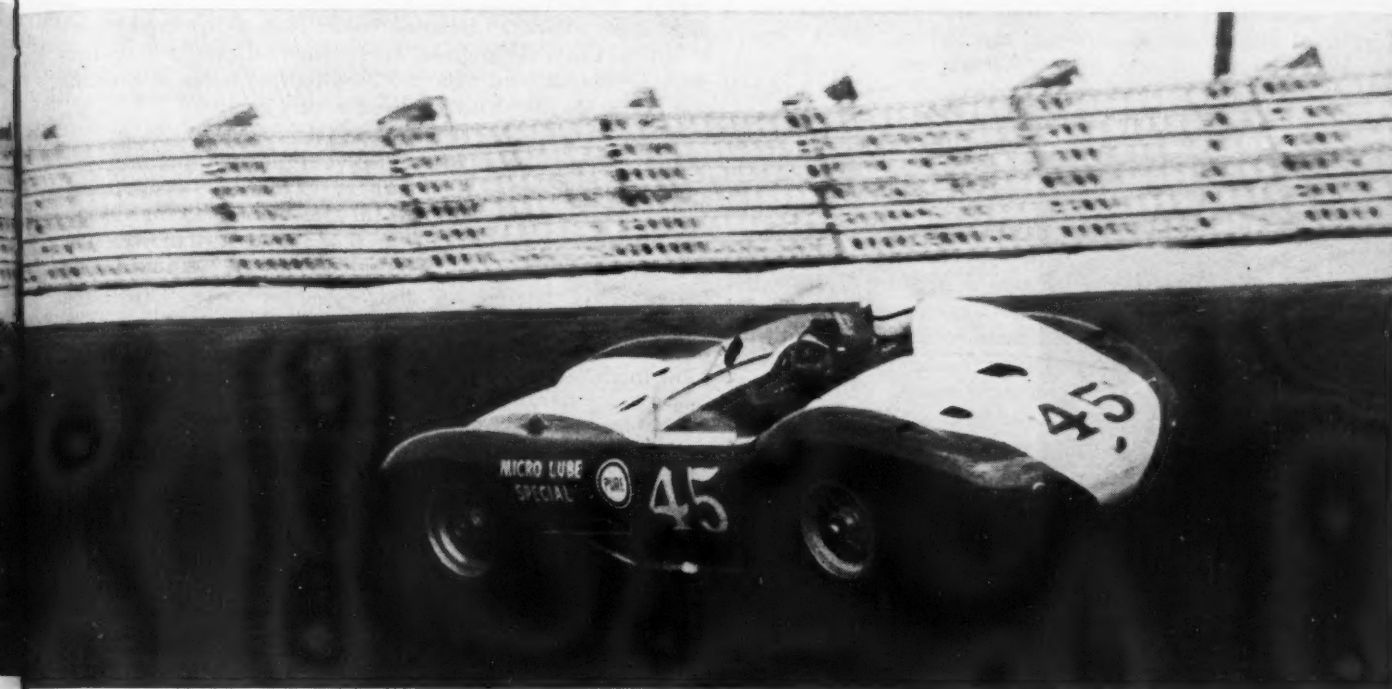
breath as the Scarab's. The design has been translated into three winning cars with no large capital investment, no wealth of engineering knowledge and laboratory equipment (they have never had a dynamometer available for the Echidnas), and no recourse to dies and special fabrication beyond the means of ordinary mortal car enthusiasts. If this design is not quite a "Build your own Scarab" concept, it is obviously a "You, too, can build an Echidna" concept. The Echidna record of 25 overall or class firsts in 35 starts is, for the private special builder, as sensational as a first at Le Mans. Dozens of special builders would be overjoyed with half such a record.

GRIERSON DURABILITY

The engines in the Echidnas are fundamentally as conventional as your neighborhood Corvette's. But, without question, a fundamental reason for the Echidna success lies in the power department. The apparent paradox is worth a long look. The single Echidna racing in C Modified in 1958 covered slightly more than 900 competition miles; the three cars (one in B Modified, two in CM) in 1959 raced 1800 miles and neither of these totals include practice periods. At no time during either season were any of the engines torn down. All cars ended each season with the same combination of bearings and moving parts. Ed Grierson's comment on this is frustrating and bewildering: "As long as the oil pressure stays put, I leave 'em alone." This is not cross-fingered bravado. It is based on an exact knowledge of V8 operation, stresses, loads, and thermal factors. Grierson's statement reflects hard-headed engineering reasons why the oil pressure stays put.

The basic power unit for the three cars is the standard 283-cubic-inch Corvette plant. A nice choice of available extras and extraordinary care in balancing and assembly are the only points to distinguish the engines in the two C Modified cars from those available in Chevrolet showrooms around the world. These two cars run with stock iron cylinder heads, stock Corvette pistons, and the Duntov cam-

Echidnas stayed with Scarabs and Maseratis. Here's how they found the stop and go power.



shafts that can be bought across the counter.

An eminent example of the Echidna "Will it work?" philosophy and its economy of design lies in the choice of standard Corvette Rochester fuel injection. Again, Grierson rattles some cherished prejudices: "Everybody says Rochester won't do and they all go the elaborate and expensive injected gas-feeding route. After the two seasons we've had, I'd say it'll do fine."

Bill Larson will give you one of his long, lean looks about this time, however, and say, "Don't think it's just a question of bolting on the Rochester and having a go. Ed has probably learned as much about this unit as anyone this side of Detroit." In fact, Detroit has had more to do with Echidna fuel injection than manufacture it. All the units, following enrichening modifications by Grierson, were shipped to the factory for careful calibration.

BROUGHT UP TO B

Rochester f.i. on the two stock-engine cars is interesting, but the same installation on the big 5560 cc car is startling. John Staver's B Modified car — the prototype toward which the other two Echidnas will be developed — sports a Scarab-size 339-cubic-inch engine with Rochester feeding. The stock heads have been fully ported. Valve sizes are up to 1 15/16-inch (intake) and 1 5/8-inch (exhaust). The valves are stellite-faced. The roller tappet camshafts are from Racer Brown with final work done by Merlin Grierson. The pistons are Forged True.

Again, extremely careful balancing and meticulous assembly provide a clue to this car's success. It is almost impossible to exaggerate the importance of this point. Grierson's is the kind of carefulness that the average mechanic, enthusiast or not, simply never even approaches.

The necessary new crankshaft, pistons and rods to go from 283 cubic inches to 339 cost about \$500. Preparation of the block including steel main bearing caps (Staver: "Why do the full job at the top end and not protect the bottom?") totals another \$150. The roller tappet cam-

shaft crosses \$250 off the budget. The radiator on Staver's car is tube and fin (available from R.H. Taylor Radiator Works, Tampa, Fla.) and offers considerably improved cooling capacity. The 1960 Corvette optional aluminum radiator now offers a further improvement, saving 26 pounds from stock. The 1960 Corvette aluminum cylinder heads, offering a weight saving of 53 pounds, will certainly be adopted for all the cars.

VERY LITTLE OIL

Standard Rochester fuel injection manifolding and standard headers are matched below, remarkably, by the standard five-quart-capacity, competition Corvette oil pan in each car. Here develops an interesting distinction between the Echidna's Corvette power and the many others using this engine. Most fabricate a new oil pan for greatly-increased oil capacity, the Sadler Mk. III carrying a 12-quart setup (SCI, March, 1959). Also, Corvette engines from stock on up are notorious for oil-breathing proclivities that lay down clouds of blue smoke on acceleration. Modified engines are seen with as many as six breathers in an attempt to meet this problem. All Echidnas sport just two additional valve cover breathers and never stream a blue screen. Nothing but 30-weight, corner-gasoline-station oil has been used, by the way.

Furthermore, the whole subject of clearances between engine moving parts affects this picture. Once again, the Echidna flouts convention. Grierson takes an exceedingly dim view of those who set up engines with terrifically large clearances. "Apparently," he says, "they figure on less friction. They lose sight of the fact that, as a result, the bearing and the journal will not be concentric circles and bearing and lubrication troubles will result."

Grierson uses standard Chevrolet manual clearance specifications throughout the Echidnas. "I go to the large side if they give me a range, that's all," he notes. No Echidna has ever suffered oil pressure problems or bearing failure. On teardowns after the two racing seasons, bearings have

PHOTOGRAPHY: PERRIN



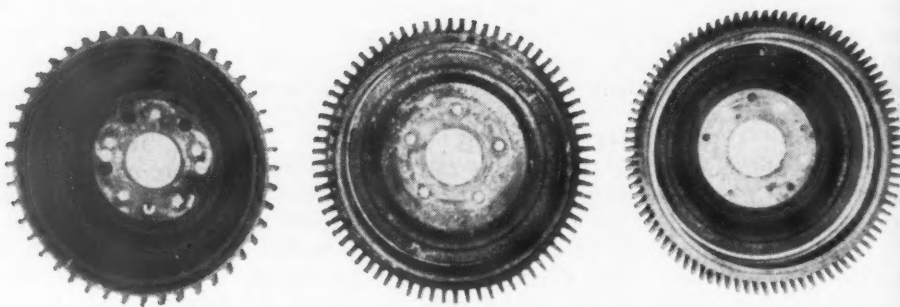
Ed Grierson, spark plug of the team, also did much of the Echidna's practical engineering.



Ceramic-metallic linings used for 1450 competition miles are still effective, despite appearance.



Grierson on the B Modified car leads Sturgis' Ferrari coupe in last year's Road America 500.



Left to right: Stock Corvette drum, first Staver-designed and produced 72-fin drum, and second design with 96 fins. Four of the efficient 96-fin cast-iron drums tip the scales at only 108 pounds.

The position of the generator is a "Grierson original" for at least three good reasons and it's a typical Echidna touch. Mounted low to the right (when facing the engine), the new position allows a much shorter fan belt and eliminates the belt-throwing tendencies of Corvettes. Its original high position interfered with the headers. And the new position lowers the center of gravity a bit.

The header tanks, to take care of surge, are fabricated from steel and weigh five pounds. The cooling system has a 21-quart capacity and no thermostat is used. The fuel

pump is old-style Stewart-Warner on Grierson's CM car, Stewart-Warner adjustable electrics being found on Staver's big job and Larson's car. No fuses are used on Echidnas but there is a resistor-circuit-breaker in the light switch.

DRIVE DEPARTMENT

Echidna transmission is unremarkable but throughout the drive train natural advantage has been taken of available components and techniques that are too often overlooked in similar projects. If the would-be imitator among you wonders what is meant by this, he will have to keep wondering. Any successful racing car project deserves to withhold some of its secrets from the hungry eyes of a national magazine's circulation! (*Van der Feen hasn't left too many of the Echidna's secrets unrevealed . . . Ed.*)

The clutch unit has the Schiefer treatment as does the lightweight flywheel. The aluminum pressure plate has the available bonded bronze face. The housing is the standard Corvette aluminum version which has been at your local Chevrolet dealer for several months at an 18 pound saving over the former steel model.

The four-speed Corvette gearbox drives through a stock, shortened Chevrolet shaft to the rear end. The engine and, therefore, the drive train are offset to the right to compensate for the driver's weight. This required modification — shortening — to only the right half of the axle shaft housing, the left half remaining strictly stock passenger car — shaft, bearings, seals and all. This offset, of course, also puts more weight on the rear right wheel to compensate for torque lift under power.

The Positraction differential is standard, across-the-counter Chevrolet without modification. All three cars have settled on a 3.70 final drive ratio despite a wheelspin problem with the B Modified car. The acceleration advantage on all circuits which Echidnas have tried outweighs the 20 mph drop in top speed from the 3.55 ratio (145 mph vs. 165 mph).

ECHIDNA CLUE: STOPPABILITY

Finally, we come to the Echidna stopping department. The brakes, their explanation, and their performance provide a suitably shocking note on which to climax this examination of a particularly inexpensive and successful racing design.

From the beginning, all the Echidnas have used cera metallic linings, a much-disparaged and much-overlooked material which Staver, Larson, and Grierson have found to be spectacularly efficient, trouble-free, and effective. Their theory on cera metallic's reputation is interesting and justified by their experience: they believe that people are in the habit of judging brake lining and drum condition by appearance. The fact is, as they have discovered, cera metallics and their mated drums are just beginning to perform properly when they appear to be on their last legs. One of the pictures confirms this.

The record: One four-wheel set of linings ran nine hundred 1958 racing miles and 500 competition miles in 1959 without being replaced; the same set was used throughout. Two other four-wheel sets of linings (and drums) ran 1300 racing miles in 1959 without attention. All these figures are over and above pre-race practice mileage.

Obviously, here is one of the most profoundly important facets of Echidna success. Brake troubles are legion with specials. The Echidnas suffer none. Staver puts it this way: "With all the minor problems, as with any special, we've never had a bit of trouble with brakes. If we have no fade problems, excellent stopping, and no bell-mouthing — what more do you want?"

Part of the Echidna solution lies in the drums—although only part of it. Larson's car had a fine racing record during

1959 but used Corvette finned drums with the cera metallic linings. Only at the end of the season did he begin to lack the braking power of the other two cars. It was a question of drums.

At the beginning, for the original 1958 car, it was felt from previous Corvette experience that more cooling and drum rigidity were necessary than stock equipment provided. Staver worked up cast-iron drums at his foundry with 72 fins (see picture). This was a stunning design showing a keen understanding of drum technology. These were entirely satisfactory on his car throughout the 1958 season. The careful design suited the linings, dissipated heat rapidly, and entirely eliminated bell-mouthing.

DISCS NOT DISCUSSED

Disc brakes were not considered. Their glamor and newness usually impresses special builders but the Echidna team felt their expense is a count against them and numerous troubles seem to arise after the adoption of discs.

A high-silicon alloy drum was not tried because of the material's incompatibility with cera metallic linings. Aluminum or Al-Fin drums were not tried because they felt nothing within their reach but an all-iron design could give sufficient tensile strength at elevated racing temperatures. They feel that an aluminum drum with satisfactory characteristics will definitely be developed, probably utilizing Vanasil (22 percent aluminum-silicon alloy) but their attitude is, "Let GM develop it. We'll adopt it."

During 1958 a Chevrolet power brake servo was used but it was discovered that the unit was inoperative for half the season and provided little help when it worked. Its 12 pound weight was discarded, resulting in high but not excessive pedal pressures for all Echidnas since. The Echidnas have always used standard Chevrolet brake cylinders and an experiment with the larger 1960 Corvette cylinders returned them to the earlier design.

Cera metallic lining's reputation for grabbiness* is misunderstood, the Echidna group feels. "If kept warm, as in a race, cera metallics give no trouble," Larson explains. "But if, after severe application, they are allowed to cool, they can be a bit grabby. This is not a race problem, at least not this side of the Mulsanne Straight."

Staver agrees that cera-metallic linings do groove drums. "After a couple of races," he says, "the linings look like they're in shreds and the drums look like someone has been etching them with acid. This is about the time everybody starts throwing away drums, but we found drum wear suddenly stops. We kept going and learned they were just starting to work right. Cera metallic linings with cast iron drums are amazingly good brakes — and, after all, the grooves increase the lining area!"

THE 1959 DESIGN

For 1959, more out of the need of an additional "long, cold-winter project" than dissatisfaction with the first Staver-foundry drum, they undertook the design of a new drum boasting 96 thin transverse fins and a hefty circumferential fin around the mouth. This turned out to be a superb cast-iron unit weighing 27 pounds; four were used throughout the season on the "test bed" #64 car. It will be adopted for the other two in the future and may be offered commercially. The 1958 foundry design was on Grierson's car (with the 1958 linings!) during the '59 season. The 96-fin design is very satisfactory but neither Staver nor Grierson feel they have ever asked the ultimate of their Echidnas' braking powers.

"I suppose after this article comes out," Staver laughs, "everybody will try to get into a braking contest with us next season. I think we'll still have a few surprises in store."

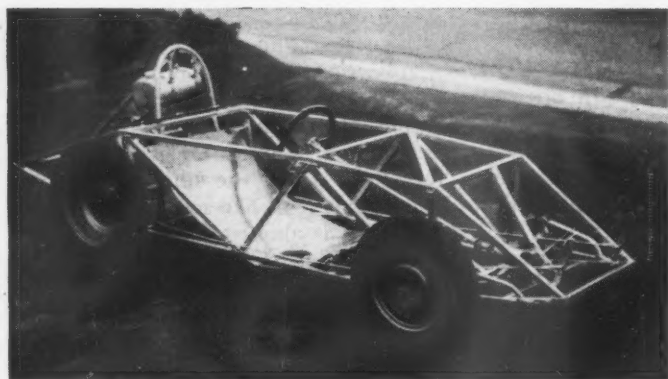
* — SCI, Dec. 1958, page 32

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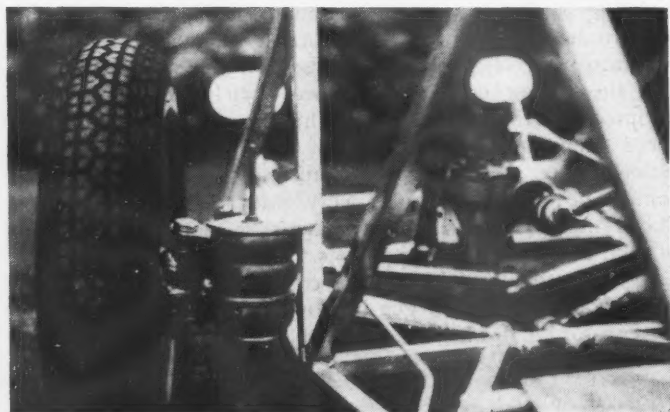
THE LEAST FOR THE MOST



by Griff Borgeson



With no guide to scale, the Schapel kart's chassis, above, could be that of a full-sized car. Below is the neat rubber compression spring layout at the front wheels, allowing precise control of the suspension rates.



► Sooner or later it had to happen and it's not surprising that Rod Schapel did it first. The NSU-Baumm vehicle, the Flying Deck Chair (SCI, Nov. '56) was a two-wheeled approach to the concept of the minimum-frontal-area record machine which the driver wears like a scuba suit. Schapel's is the first such four-wheeler.

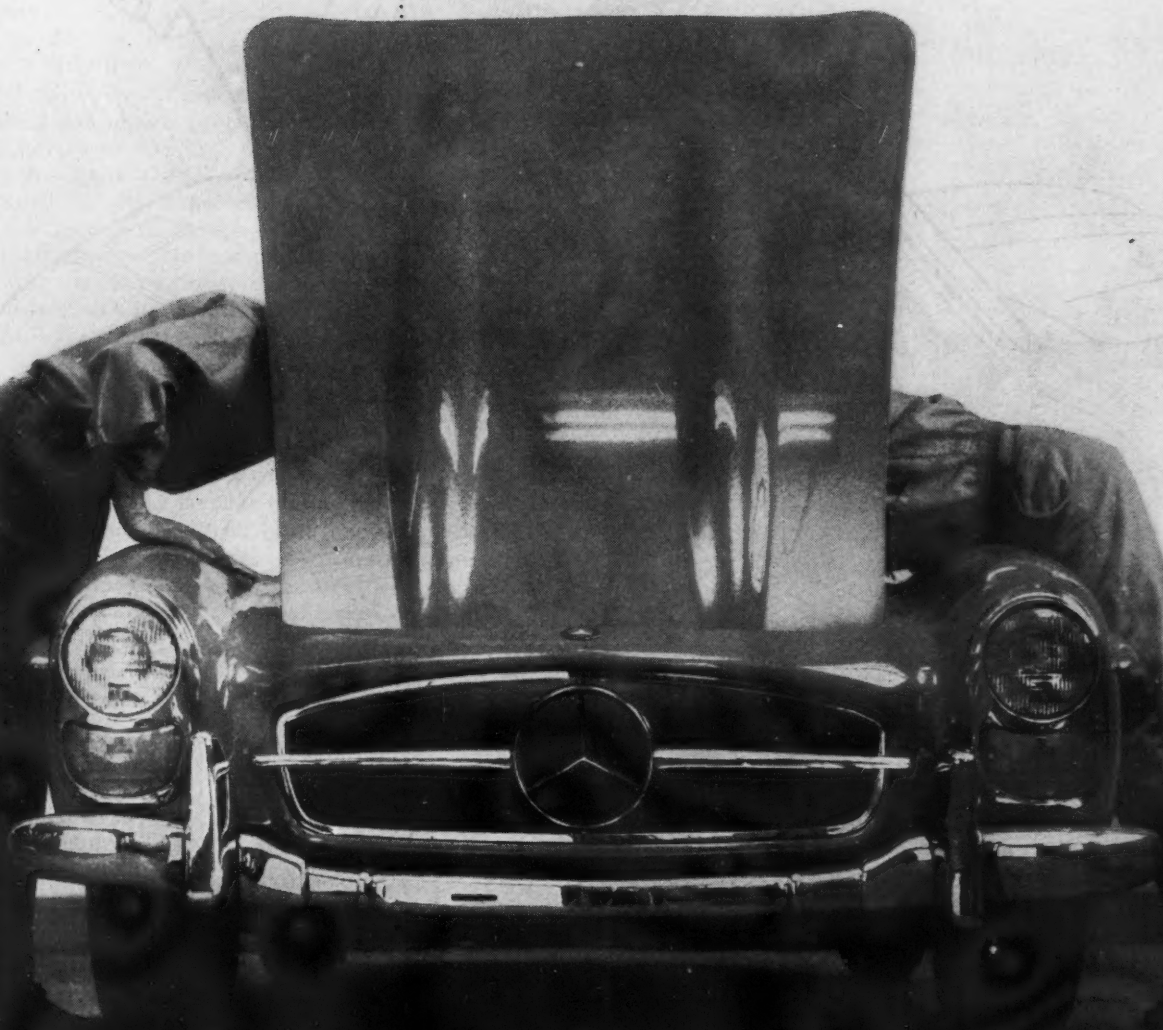
Ready to go, the 4.2-square-foot frontal area streamliner weighed 186 pounds in '59 Bonneville form. According to bhp-required curves based on early estimates the tiny tear-drop would need only ten bhp to go 120 mph and 30 bhp to go 160. Actual tests of rolling resistance showed this factor, in practice, to be smaller than anticipated; its theoretical speed is much higher with the just-quoted power.

Schapel is a 30-year-old mechanical engineer who is employed by the Task Corp. of Los Angeles to cope with often far-out problems in mechanics, optics and aerodynamics; for him the calibration of wind tunnels is a routine chore. In the course of his long and active interest in speed on land he has designed the Chet Herbert streamliner bodies, including: the one with which Dana Fuller set the absolute World Record for Diesel-powered vehicles; a former F.I.A. International Class C record holder; the body for the car with which Ernie Immerso plans to attack the absolute piston-engine record in 1960. The best speed achieved by one of these very stable bodies to date is the 272.93 mph clocked at Bonneville in '58 by the Herbert machine powered by a trio of Chev V8 engines.

Schapel's latest project was the inevitable result of a casual stimulus. It began early in July of '59 when Schapel and his associate, Bill Orndorff, decided to spectate on the Salt. Orndorff is employed by the Standun Machine Co. which manufactures Rocket karts, which are marketed through Montgomery Ward. He had one of the karts in his garage and suggested that they take it to the Salt just for amusement. Schapel slept on this thought.

(Continued on page 98)

"Sent your entry in yet?"



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Sample ideas like these can win you \$25!

Dye an old shoe bag the color of your car interior and lock-stitch it to the back panel of the front seat. The individual compartments make excellent storage places for fragile objects.

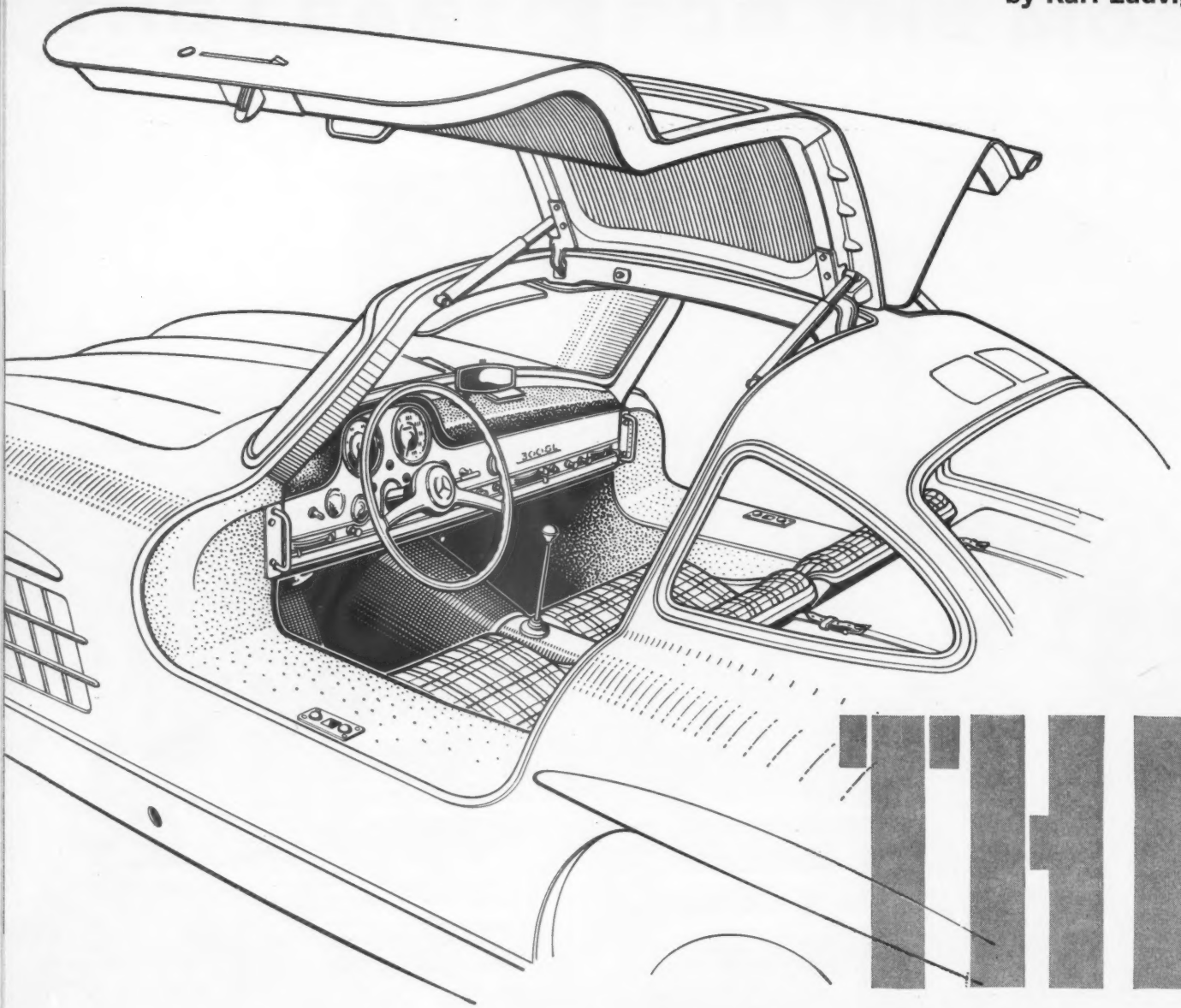
When parking a Citroen DS 19, set the air-oil suspension to the car's highest level. This puts the bumpers as high as those of domestic cars.

Now step on it and send in those entries!

If you can find a better bourbon... buy it!



by Karl Ludvigsen



THE 300SL STORY

► It's unusual enough for a successful sports-racing car to reach the open market completely outfitted for touring, but rarer yet for the road edition to be *hotter* than the original!

But this was precisely what Mercedes-Benz achieved with the near-incredible 300SL series, a line of cars which enhanced the gloss of the already glittering Stuttgart star. Interestingly it was only by virtue of a series of happenstances that the car was built, that it was raced, and that it was eventually produced for sale. The complete story appears here for the first time.

Immediately after the war Mercedes' talented development chief Rudolf Uhlenhaut busied himself with some very personal racing car design projects, primarily to stimulate himself and his personnel. One of his main preoccupations was with the space-type chassis frame, which had not at that time been used in any important racing cars and which Uhlenhaut saw as one of the major ingredients of postwar competition car design. He designed a tiny supercharged 500 cc car, with its four-cylinder engine placed transversely behind the driver, utilizing a small-tube trussed frame structure. In connection with some Grand Prix studies he also toyed with the idea of uniting some components of the 300 sedan with such a frame to make a fast sports car. These whims of his were humored by the Mercedes directors so long as they didn't interfere with the more serious business of building up the Mercedes passenger car line.

As it finally evolved, the 300SL's frame is probably one of the most complex of its kind ever built, certainly ever built in any quantity. The whole idea of a space frame is to place its various members so that they will be under tension or compression only; so that none of them will be bent or twisted. Accomplishment of this naturally calls for three-dimensional designing of the highest order, allied with thorough testing of small models as was done here. When this is achieved the separate members can be very small in size or thin in section, giving extreme lightness in proportion to the rigidity obtained. Since the 300SL was destined for sports car racing over all kinds of terrain the emphasis was placed on rigidity, the tubular structure finally weighing 181 pounds.

Part of the complexity of the SL frame is caused by the large passenger volume that must be supplied in the middle of a sports car. This forced the use of a very deep sill framework, and the resulting upswinging doors, but it was not quite possible to maintain the same level of torsional stiffness through the center that was obtained at the front and rear thirds of the frame. The same was true to a lesser degree of the space frame for the later W196 Grand Prix car which, through being more compact, had better torsional stiffness overall than the 300SL frame with less than half the weight!

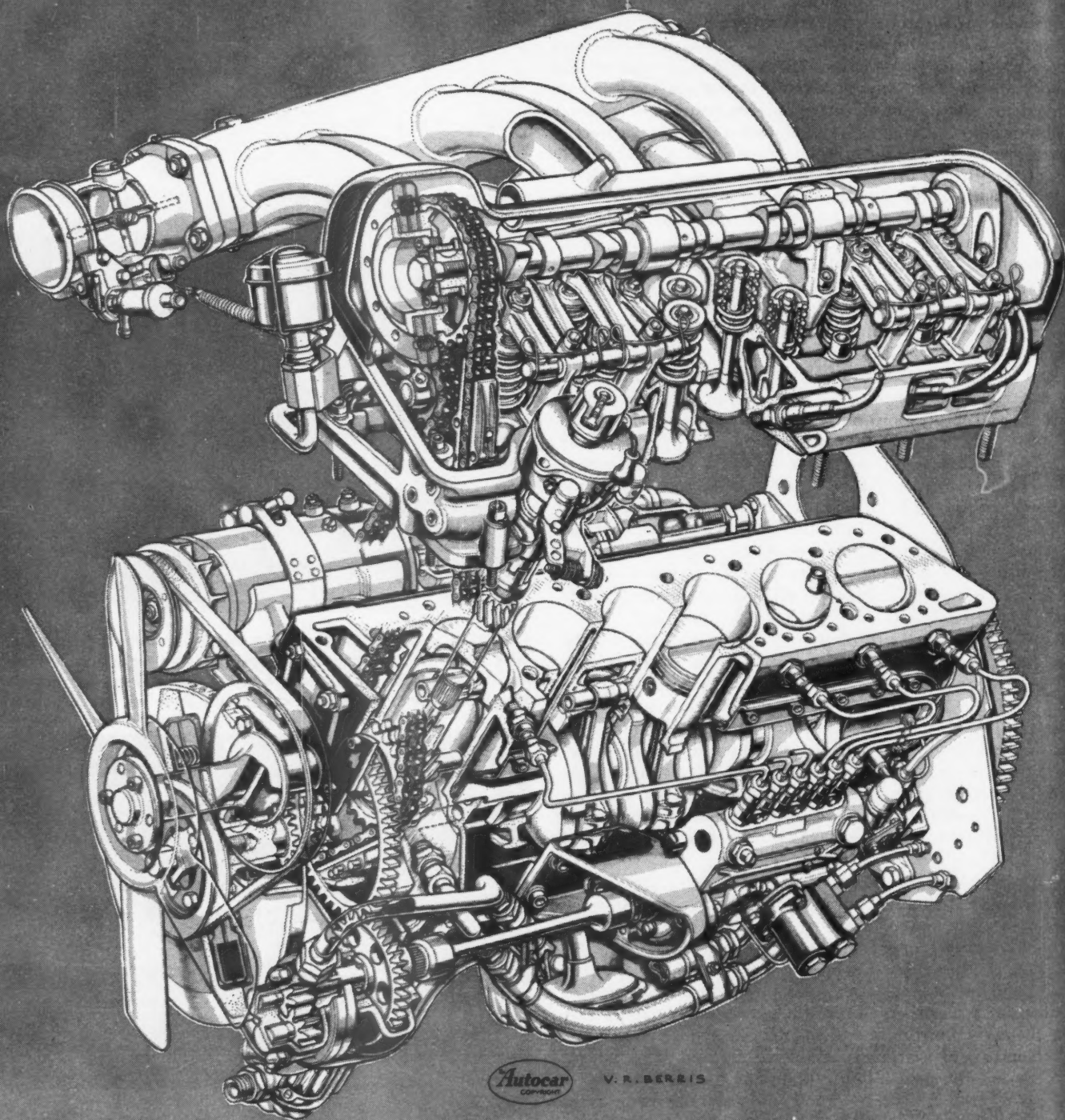
A big crossmember at the front joins the network of tubes to stock Type 300 suspension units, modified only in shock and spring rates and tiny details of geometry. The unequal-length wishbones are made up of separately-forged side pieces, united in the bottom arm by a pressed pan which actuates the vertical coil spring with its enclosed tubular shock absorber. As in all high-speed Mercedes cars since the early Thirties, the wheels are allowed a tiny amount of fore-and-aft as well as up-and-down motion. This is provided by swinging the whole suspension system from a vertical pivot, and limited by a rod and bushings restraining an inboard arm. Also from the 300 is the micrometrically precise Daimler-Benz recirculating ball steering gear, which actuates a three-piece track rod system and is protected from road shock by a small damper linked to the central track rod.

Another legacy from the 300 is the original rear axle assembly, though the tread was narrowed $3\frac{1}{2}$ inches from the even 5 feet of the sedan. This still left the front tread of the coupe about two inches narrower than the rear di-



First 300SL prototype (above) had a much simpler shape than later cars. Wind tunnel testing of this form showed the need for side vents to relieve under-hood pressures. These were included in production versions. New Roadster body (below) has conventional doors and fair-sized trunk.





mension, an arrangement that broadly speaking promotes oversteer. Hypoid bevel gearing is within the center section (of light alloy in the 1952 cars), as is a ZF cam-type differential — *not* used in the standard 300! The half-shaft housings are guided by close-spaced trunnions at both sides of the three-point-mounted differential casing, giving a true swing axle motion. In the standard coupe, laden, the negative camber of the rear wheels should be between 3 and 4 degrees, but some cars had more camber for competition use. Big coil springs, with smaller overload coils inside, work together with sea-legged tubular shocks.

To power this highly experimental rig, a 300 (M186, to be precise) engine was somewhat modified and placed in the chassis at an angle of 50 degrees to the vertical, leaning to the left with the crankshaft and gearbox offset a couple of inches to the right to bring the c.g. back to the middle again. With the chassis taking absolutely all stresses, the body could be and was a simple lightweight shell, shaped for maximum aerodynamic smoothness at the expense of a fairly large frontal area. This idea was carried through by using a very narrow coupe top, also to provide comfort during long-distance races, while the oval grille shape was derived from the 1939 Grand Prix cars.

A CRITICAL DEVELOPMENT

October, 1951 was a pivotal month in the embryonic life of the 300SL, for it was then that the F.I.A. decided to begin a new Grand Prix formula in 1954, making it inadvisable for Mercedes to proceed further with the 1½ liter blown car that was then in the drawing board stage. (An interesting side note is that the 1939 Tripoli V8 car had been tried on the Nürburgring in August of that year as a guide to their efforts.) Still wanting to gain some experience in postwar racing, the directors now turned benevolent gazes on Uhlenhaut's sports car experiment. There was still snow on the fields around the Stuttgart-Heilbronn Autobahn as the prototype underwent its first tests. A few drag races with a 300S were staged to amaze the press.

Further amazement for the whole racing world was provided by the well-known 1952 performances of the ten cars that were built for factory team use. A few variations on the basic theme are of interest, the most grotesque and demoralizing being the roof-mounted air brake that turned up for Le Mans practice. Manually operated, it flicked up with a "whoomp" that visibly slowed the car at the end of the Mulsanne straight. It went unused then but surely provided data for 1955.

For a sports car race at the 'Ring, where average speeds are low, four open roadsters were prepared, two of them having wheelbases experimentally shorter than the standard 94½ inches. With hopes of showing up the Grand Prix cars, two roadsters were fitted with triple-carbureted Roots superchargers, driven from the camshaft. The engine of this colorful 300SLK bore type number M197, hinting that the famous M196 Grand Prix engine was well into the planning stage by mid-1952! The charger didn't agree with the six's cooling system and the 300SLK's weren't raced, though one of the normal roadsters did show up later under John Fitch in the Mexican Road Race.

After the '52 season work was immediately under way on revised cars for the next year, but in January word was passed down that there'd be no racing in 1953, because of the pressure of production car development, not to mention the new Formula 1 cars. Some time could still be devoted to the 300SL, however, and by October, 1953 another prototype was seen which embodied virtually all the features that jolted the motor sporting world when the production car was unveiled at the New York show in February of 1954.

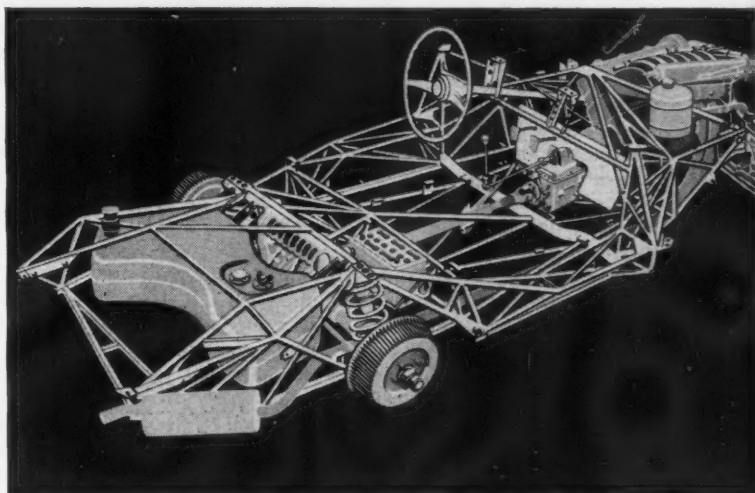
A LOOK UNDER THE HOOD

Since one of these features was found under the hood, it's time I described the engine in more detail. The six-cylinder

block is of cast iron and ends, at the bottom, right at the crankshaft centerline. It is thus short, for minimum weight, and both sides of the block are cast completely open for (1) good control of the casting cores, (2) easy inspection after casting and (3) light weight, since the large openings are covered with sheet steel plates. A surprisingly light engine was thus obtained without sacrificing the sturdiness, simplicity and fine wear character of cast iron. Seven main bearings, with dowel-located two-bolt caps, support the forged crankshaft. The 1952 SL engines had a fair-sized vibration damper at the crank nose, but the production version swings a weighty disc that looks more like a flywheel, to cope with sustained high rpm.

Wide, deep fillets characterize the forged rods, which have drilled shanks for pressure lubrication of the wrist pin bushings. The forged Mahle pistons are non-compensating types with full skirts but with the aluminum around the wrist pin holes relieved so that only the thrust faces, slipper-like, contact the bores. Use of three compression rings may be bound up in some way with the problem of oil dilution in a fuel-injection engine (a not inconsiderable bother with a 300SL that must be cold-started and driven slowly, God forbid). A drainage slot is cut between the bottom compression ring and the single oil ring.

The single overhead camshaft is serviced by a very long double-roller chain, to the amazement of the English experts who feel that a two-stage drive is near-indispensable



Roadster frame has lower sill line and revamped gas tank. Rear suspension has also been softened with the aid of a compensating coil spring.

to prevent thrash, etc. On the driven or tension side the Mercedes chain turns an intermediate sprocket, shaft and spiral gear set which drives the Bosch distributor and scavenge oil pump. There's a tensioning sprocket on the "loose" side, placed to wrap the chain as far around the cam drive gear as possible. Chain flutter is virtually prohibited by long synthetic-faced guides along every open stretch of chain, and another friction-type vibration damper is overhung at the driven end of the camshaft.

Four big journals on the cast iron camshaft run direct in the light alloy supporting pylons cap-screwed to the head. Originally a mild type 300 camshaft (part number 186 051 2101) was fitted as standard with a "sports" cam (part number 198 051 0001) optional, but the hotter cam, with its improved output over 3,800 rpm, was made standard on the Roadster model. Very long heavy-sectioned fingers recall vividly the valve gear of Porsche's big sixes; the surfaces that contact the cam lobes are nitride-hardened.

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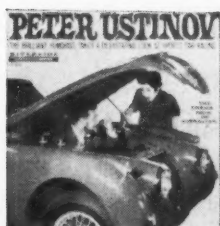
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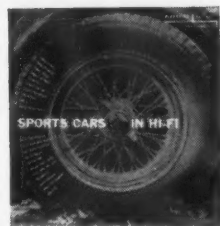
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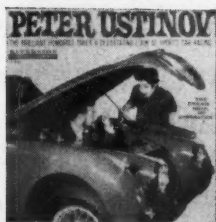
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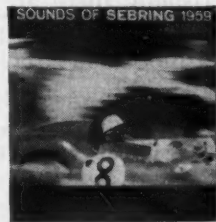
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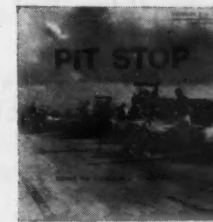
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"Heat range" is one of the main factors governing spark plug performance under various conditions. The term "heat range" simply refers to the classification of spark plugs according to their ability to transfer heat from the firing end of the spark plug to the cooling system of the engine.

A plug that transfers heat away from the firing end *slowly*, so that the temperature of the firing end

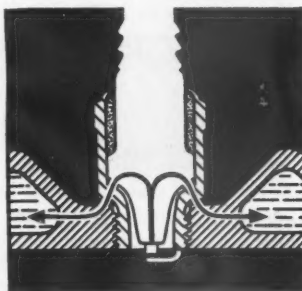
remains relatively hot, is called a "hot plug." (A "hot plug" does not produce a "hotter" spark.)

A plug that transfers heat away from the firing end *rapidly*, so that the firing end stays relatively cool, (compared to a "hot plug"), is called a "cold plug."

Usually there are several different heat ranges of spark plugs for any particular engine. What you want is a plug that is neither too "hot" nor too "cold" for the conditions affecting the engine. (A plug "just right" under one set of conditions may be too "cold," or too "hot," under other conditions.)

If the plug is too "cold," deposits build up on the insulator nose. These deposits bleed away voltage and can cause a plug to misfire. In severe cases, the plug may not fire at all.

If, however, a plug is too "hot" for the existing conditions, you may encounter preignition. This means that the glowing tip of the insulator ignites the fuel charge *before* the plug actually sparks. This wastes power, and, in most cases, will cause severe engine damage.



CHAMPION SPARK PLUG CO

The general rule on selecting heat range is this: *the lower the combustion chamber temperatures, the "hotter" the plug should be. As conditions cause combustion chamber temperatures to rise, a "colder" plug is needed.*

There are at least nine factors that have some effect on those temperatures:

- 1. COMPRESSION RATIO.** The higher the compression ratio, the higher the combustion chamber temperature — and the "colder" the plug should be.
- 2. FUELS AND FUEL BLENDS.** Fuel blends that have special power-producing additives result in higher temperatures and have a lower preignition temperature, and thus demand a "colder" plug.
- 3. CARBURETION.** A leaner fuel/air mixture tends to increase temperatures. The leaner the mixture, the "colder" the plug should be.
- 4. IGNITION TIMING.** In normal spark advance range, advancing timing increases combustion temperatures, requiring a "colder" plug.
- 5. GEAR RATIOS.** Higher gear ratios tend to lug an engine. This subjects spark plugs to higher temperatures, calls for a "colder" plug.
- 6. ATMOSPHERIC PRESSURE AND ALTITUDE.** Higher pressures (at lower altitudes) tend to lean out fuel mixture, demanding a "colder" plug. Higher altitudes (lower pressures) call for a "hotter" plug.
- 7. SUPERCHARGING.** Supercharging increases effective compression ratio, resulting in increased combustion chamber pressures and temperatures, requiring a "colder" plug.
- 8. TYPE OF COMPETITION.** In a drag race you are only on the throttle for a few seconds. The combustion chambers do not have a chance to build up nearly as much heat as they would in a 100-mile sports car race, for example. Thus, with other conditions equal, a car being prepared for a drag race would take a "hotter" plug than the same car being prepared for a long run.
- 9. MANIFOLD DESIGN.** This can be a complicating factor. Poor manifold design may cause poor fuel distribution, creating different mixtures in different cylinders. This results in different temperatures in the various cylinders and should be corrected.

Before you try selecting the right heat range for racing, your car must be properly tuned. And, of course, before you can go to a "hotter" or "colder" plug, you need a starting point. You will find it in the "size chart" that your Champion dealer has. This Champion chart gives the recommended "average" spark plug heat range for ordinary use of your engine, not for the extreme conditions of competition.

Suppose the spark plug recommended by the chart is a J-8. For competition, start with a plug one or two

steps colder (J-7 or J-6), depending on your appraisal of the conditions affecting your engine.

Here's a simple tip for recognizing a "hotter" or "colder" type. Think of the Champion numbering system as a thermometer. The higher the number, the "hotter" the plug. A J-11 is "hotter" than a J-8, but "colder" than a J-12, for instance.

The next step is to install a set of Champions of the selected heat range for a trial run. Then "read" the plugs' firing ends to see if you need to go a bit "hotter" or "colder."

Here's how to set up the plugs for a reading. If you're going to use the engine for drag competition, make a regular competition-type run. Then cut off the ignition as you cross the line — at peak power. Pull the plugs out there. Do NOT drive back near the starting line or you will wipe out the indications you're looking for. (We'll tell you what to look for in just a moment.)

If you are going into distance competition, make a run for two laps, going as fast as the course will permit. Then quickly shut off the ignition at full power and disengage the clutch. Pull the plugs without doing any more driving.



After a test run, if the insulator nose of the spark plugs shows *slight* brown to grayish tan deposits, you have the correct heat range.

If the insulator nose is clean and white — with *no* deposits — the plug is too "hot." Try a "colder" plug.

If the insulator nose has accumulated either dry, black fluffy carbon deposits or wet, oily deposits, the plug is too "cold." Try a "hotter" plug.

Remember — you want a spark plug that is "hot" enough to keep excessive deposits from forming and causing misfire, yet "cold" enough to avoid the danger of going into preignition, which causes power loss and can damage the engine.

And remember — there's a Champion Spark Plug in the heat range that's right for *your* engine — and your kind of driving. That's one reason Champion is the speed world's favorite spark plug.



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Experienced
Beginner

from page 29

The curriculum included courses on how to drive a leaping, jouncing sprint car in a feature with hands bleeding from the preceding heat events. Still another taught students how to keep breathing while an Offenhauser-powered excavating machine bulletted dirt and rocks into their faces for a hundred miles.

It was a tough school — made even tougher by the fact that it was completely unrecognized. Graduates did not receive their diplomas to the applause of parents and friends. Nor did they go out into the world equipped to demand grand sums for their services. Offsetting this was the fact that the classes were small. No more than two or three, and sometimes not even that many, made it all the way through to the Memorial Day graduating exercises at Indianapolis. Eddie completed the course in 1956, when he took and passed the final exams at Indianapolis all in one day.

After passing his test Eddie ran at Indianapolis three times. Last year a bolt in the gear tower of his engine came adrift which put paid to his chances. Mechanical trouble of various kinds also forced him out in '57 and '58. This year he will drive a brand new car sponsored by the Dean Van Lines Company. With three tries behind him, and a new car under him, Eddie Sachs can be considered a veteran Indy driver with a good chance at this year's running of the 500.

This briefly outlines the past ten years in the life of Eddie Sachs. Not recorded were the 11 racing accidents spread over this same period.

What has Eddie earned from driving besides lacerations and a tenseness that manifests itself in a rapid-fire speech pattern? Only the last three or four years have been financially rewarding. In 1957 he drove in 11 championship events. He finished seventh in U.S.A.C. point standings and won purses totaling \$26,451. The Midwest sprint championship title was worth \$7,831. His drive in the 500 mile race at Monza brought in \$1,761. A fourth place on the Eastern circuit added \$2,201 to the kitty. Sixty per cent of this \$38,244 was split two ways, ten per cent to the mechanic, and the remaining 50 per cent to the car owner. Thus in one year he drove in over 30 violently competitive races and pocketed \$15,297.60. Considering that the average American-style driver earns about \$4,000 a year Eddie can be thought of as being among the top ten.

What then can prompt a man in his position to start all over again in the different, if allied, field of road racing? That the transition might be a difficult one cannot be denied. Listen to Eddie talk about driving an Indy car: "I make 39 separate movements while turning one lap at Indianapolis." With arms outstretched making driving motions he makes his point vocally and graphically. "Now,

don't misunderstand me, I don't think about these moves — they're automatic. Anybody who stops to think is either very slow, or very dead." With increasing intensity — many drivers don't need a car to start racing — he continues, "Each one of these moves blends into each other — you're always busy, setting the car up going into a corner, holding it in the groove while going through the corner or trying to get as much bite as possible coming off the corner — you're always busy."

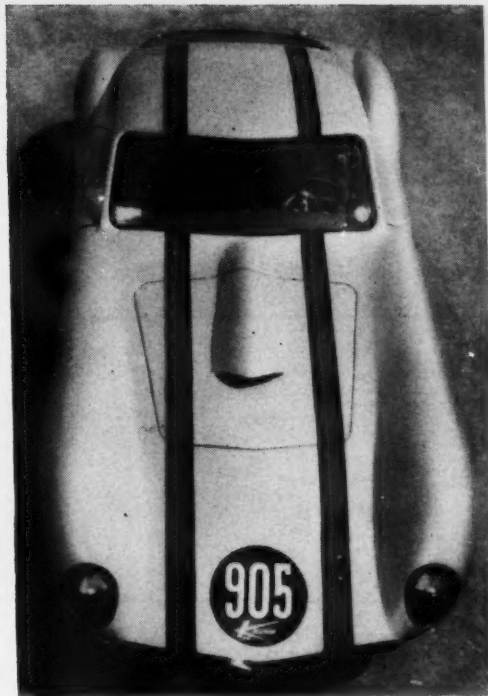
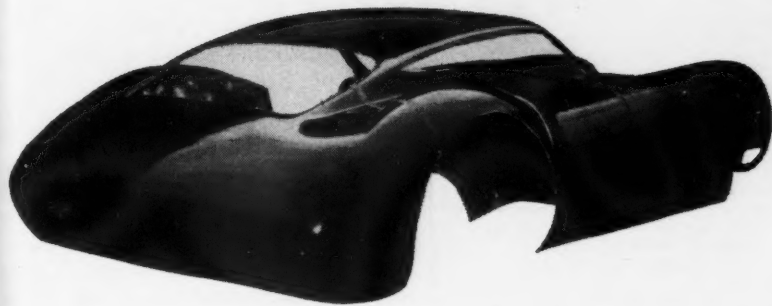
Contrasted with road racing as practiced with Formula 1 cars, Indianapolis might be considered a constant series of 130 mph bends. It can be seen that Eddie Sachs the Indy driver has a lot to learn, and unlearn, before becoming a threat on the great G.P. circuits. Characteristically he thinks that he can do it, given proper equipment, in a year or two at the most. If he did not think this way — and act the same way — it would be an odds-on bet that he wouldn't make it. But Eddie Sachs shares, with good race car drivers the world over, that massive dose of self-confidence that makes them competitive.

A secondary consideration prompting his switch to road racing might be money. It would run, however, a very poor second to his urge to excel in every branch of his chosen profession. Eddie is an astute business man, who at present owns and operates a cocktail lounge and several small apartment houses. Any man who has worked his way up in the rough-and-tumble business of American track racing is bound to acquire business acumen. Sachs is no exception. He participated in the fantastic postwar midget racing boom during which even mediocre drivers made \$1000 a week — although they had to drive seven nights in a row to do it. He was also on the scene when the midgets withered and slowly died. It's quite possible that Eddie sees in road racing a replacement for the waning sprint events. If this is true what better time for him to start carving his way to the top in this new-style racing?

To date Eddie has entered two road race events. One was last year's Nassau Speed Week, the other was the program held in Cuba in January. In both he used the Nisonger KLG Special. This is a Sadler-built Chevrolet-powered sports-racing car, the same one as the cutaway by LaTourette in SCI of March, 1959. At Nassau a multiplicity of mechanical problems plus a shunting by an Austin-Healey as he was entering the pits limited Eddie's participation to a few practice laps. Cuba was somewhat better. He ran nine laps before a piston that was more liquid than solid sidelined the car. These initial poor showings on Eddie's part make it just about certain that he will persevere until he starts winning on the twisty circuits. His first try at Indianapolis — in 1952 — ended when he was thrown bodily out the front gate. He has been trying, and coming closer each time, to win at Indy ever since. This sort of determination is completely alien to anyone except another race driver. The all-guts spirit of the American sprint drivers, plus their competitive driving and showmanship, may result in a renaissance of professional road racing in the United States. —WW

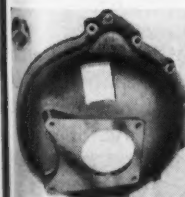
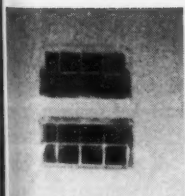
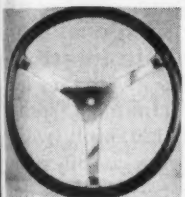
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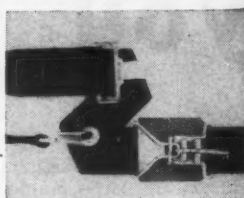
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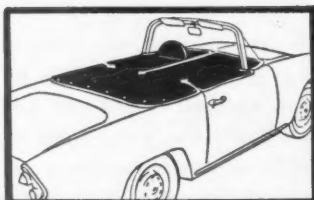
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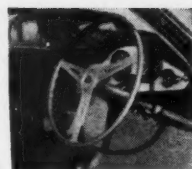
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Lotus Elite

from page 33

combined oil pressure/water temperature gauge in the center and an ammeter on the right. Pull-out switches control choke, two-speed wipers and lights (parking, head and interior lamps all on one switch), and a toggle switch on the right operates the horn and flashes the headlamps—a useful item rarely found on British cars.

On the road, one of the most remarkable things about the car is the lightness of the rack and pinion steering, and, in fact, all the other controls. It's rarely necessary to move the steering wheel rim more than a few inches, and even in the wet the slightest movement of the wheel serves to correct an incipient slide. Anyone accustomed to low-gear "spoon-and-jelly" steering might find the instant reactions of the Elite a little disconcerting at first, but after a few miles it becomes almost second nature to guide the car swiftly and smoothly through bends, and to hold the wheel lightly between the fingertips on the straight.

Similarly, brake pressure is remarkably light for an all-disc setup, and fairly weak throttle springs reduce the strain of long distance, high-speed motoring. The engine never seems to be over-worked, and thanks to its aerodynamic shape the Elite gives far less impression of speed than most sports cars—gliding along at 120 mph while others feel to be laboring at 80 mph.

Fortunately, however, this is above all a car which actually *helps* the driver when he comes upon a corner unaware. Whether on the Firestone nylon sports tires fitted as standard, or on Dunlop R5 racing tires, the tail begins to slide relatively early, but completely smoothly and controllably. The Elite can be taken through the majority of corners "on the throttle" with very little movement of the steering wheel and generally the feeling that "I could have gone much faster than that".

The chief difference between Peter Lumsden's Elite and a standard one is that it has considerably more urge at the top end—at the expense of some low-speed flexibility, which means that in traffic it's necessary to shift gears much more often. It is also much more noisy, but this is largely because of the vestigial muffler. A Stage III car with more adequate silencing would be a reasonable enough proposition on the road.

—David Phipps

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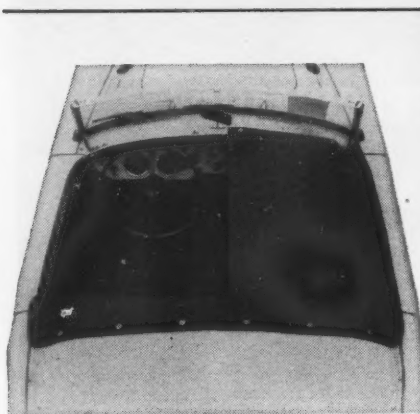
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RRR

Austin 850

from page 48

wiper switch (not self-parking), ignition switch, headlight switch and the manual choke. The latter must have the shortest run ever; the S.U. carburetor fits into the bulge on the firewall which carries the instruments.

The starter switch is mounted on the floor within an inverted bell-shaped protector just in front of the right seat. Convenient for r.h.d. cars, it's only a puzzling quirk to us since it actuates the starter through a solenoid. Why wasn't it put on the dash?

The heater and defroster are all one and the same; some of the air comes out on your feet and some goes through ducts to the windshield. The only way to control the proportion is to put masking tape over the foot-louvers, which some thoughtful person at Hambro Automotive had already done to our test car. With the engine-gearbox acting as a heat bank in front of us, we were never cold.

Though it's listed as an optional extra (\$40), the heater is in effect standard equipment. The scheme is to get an excitingly low advertised list price. This they did: \$1295. Actual "suggested retail POE price" will range up to \$1444 for coastal cities, considerably under any other "full-sized" import.

The trunk itself is quite modest, the gas tank and spare tire looming rather large in proportion. The lid is hinged at its bottom and has wire stays at each side so that loads up to 35 pounds can be carried on it.

RUBBER SUSPENSION

The secret ingredient that ensures success with the Austin's unorthodox arrangement is rubber. Five-to-one lever arms compress and tense the four carefully shaped, molded, hollow rubber springs which are used instead of steel ones. Their sophisticated design overcomes the usual basic objection to mini cars in general; if they ride comfortably when filled with people and possessions, they're abominably bouncy when the driver is alone. If they're comfortable with light loads, they handle badly and dangerously with heavy ones. The solution's rather difficult to achieve, but with rubber springs, whole new horizons are opened up. The ones used are built by Dunlop after a design by Moulton Developments, Ltd., an associate of the BMC.

A doughnut-shaped ring of rubber is bonded to two metal cones. The outer one is attached to the frame and the inner one to the end of a link to the suspension arm. They work the rubber in both compression and shear, the doughnut's cross-section being shaped to give the desired variable rate. The rubber has internal friction or "hysteresis" which helps damp vibrations too, though not enough to do away with separate shock absorbers. The same springs are used front and rear. The linkage is arranged so that the springs move only one-fifth as far as the wheels do and

are subjected to five times the forces. This permits the use of stiffer, more compact and therefore lighter, cheaper springs with very limited deflections. The rear springs are operated by bell-cranks doubling as trailing arms. The spring (short) and its push-pull link (long) are then laid horizontally under the floor where they don't intrude in the passenger compartment.

FRONT WHEEL DRIVE MECHANISM

Because of their very commonness, the advantages of conventional layouts often go neglected. The oft-maligned propeller shaft offers torsional springiness which prevents "transmission snatch" when an engine is being lugged. To regain this lost advantage, the 850 has very unusual universal joints.

Inboard they are geometrically similar to the Hooke joints used on American cars. But instead of needle bearings, the same Moulton firm that designed the springs has created rubber couplings that transmit the loads but not the vibrations.

The short driveshafts have sliding splines so the wheels may move near-vertically. The outboard joints are Birfield-built, six-ball Rzeppa constant-velocity ones.

The result of this clever package is a car with all the advantages and very few of the disadvantages of front wheel drive. (Ed. See Panhard road test this issue.)

ENGINE PERFORMANCE

Engine torque reactions occur around the crankshaft centerline. Normally, this means the engine rocks (and if it's a big one, the car rocks too). With a transverse engine, the rocking takes place fore-and-aft. When you're in gear, you can feel it pull and push the shift lever as you open and close the throttle. "Rowing along" with the shift lever is a small-car activity that just isn't necessary in the 850. Its little (848 cc) engine pulls from extremely low speeds, and very smoothly too. When driving alone it's easy to start in second gear, and one can skip directly to fourth, which pulls from about 8 mph, though it's a bit rough up till 12 mph. Of course using all the gears gives much better performance — much better than one expects from 37 bhp and 1610 pounds of laden weight. The 850 seems to enjoy being driven fast and hard but this chops the gas mileage drastically.

SHIFTING

Because the transmission gears are located crossways like the engine, we had expected the shift lever to have all the vagueness of one of the poorer column-shift devices, since the shift pattern now had to turn a corner as well as reach forward past our feet. This is not the case. Even though there are a depressing number of links and bits between the driver's hand and the selector forks themselves, the shift pattern is pleasantly compact. However, all was not perfect in the shifting department. The pre-loaded spring detent to prevent getting lost near reverse when snapping quickly from 2nd to 3rd was ineffective. We recorded far more 0-30 and 0-40 times than others. When trying thus to rush shifts, the synchromeshes were always easily "beaten", just as on the A-40 and Morris Minor whence this transmission's innards came.

(Continued on page 82)

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(Continued from page 80)

NOISE

There may be some customers who would gladly sacrifice the 850's ability to hill-climb from rest with a full load for a numerically lower axle ratio in order to cruise at 60 mph with less noise and at lower revs than 4000-plus. The decibel count is high, which is to be expected with so few mph per 1000 revs and with three gear meshings involved even in fourth speed. A curse of integral body-frame construction is its high fidelity of sound reproduction. Rubber is the best answer. Much unwanted road noise never gets past the suspension as the rubber springs are superb at absorbing high-frequency vibrations. The rear sub-frame which carries the two independent trailing arm suspensions mounts to the body shell with four rubber-bushed trunnions. No such easy method is suitable for the front-drive complex as its six mounting points must remain rigid to avoid vagueness in the steering.

SERVICING

For comments on service, we can't do better than listen to Ted Eves, one of SCI's Contributing Editors. He has driven a Morris 850 over 6650 miles so far.

"In the course of our mileage very few snags have cropped up. In early days we nodded knowingly when a heavy down-pour wet the ignition and reduced progress to a two-cylinder affair. A piece of plastic about eight inches square behind the grille and in front of the distributor stopped this. Then the car went into BMC service for a body repair and the plastic sheet disappeared; so did the trouble, for there have been downpours since. I imagine silicone grease was the answer.

"Early specifications showed grease nipples on the inboard splines of the drive shafts. It was soon discovered by the factory that normal greases squeezed out of the splines. This gave rise to knocking noises and apparently uneven running of the engine as the splines locked momentarily on drive and bump. Duckham has now produced a special grease for this application by the name of Lammol. For some time past, cars leaving Abingdon and Longbridge have had the splines pre-packed with this special "goo". The inner end of the spider has been sealed with a disc while a bellows retains the lubricant at the outer end. The greasers at this point are therefore no longer necessary, a jolly good thing for they were difficult for home servicing. They were the only hard-to-get-at points on the car. I do not count the gear shift greasers behind the cylinder block which can be ignored for much longer than the recommended intervals. In fact too much pressure at this point can stiffen up the linkage. One more point for the home mechanic: when greasing the rear suspension arms make sure that clean grease comes right through to a point just behind the trunnion bracket."

BRAKES

The little 850 has a feature whose principle will be familiar to those who studied the Corvette SS layout: a pressure-limiting valve on the rear brake lines. This points up the only difficulty with extremely nose-

heavy cars; when they're empty, their back wheels are pretty skittish under heavy braking. Apparently such a valve is cheaper than putting still smaller (than seven-inch) brakes on the rear. On our test car an emergency stop would still just barely lock the right rear wheel first, probably evidence of some dirt or oil on the linings.

Seven inches sound like small drums, but with only 1320 pounds of curb weight they haven't much to do. Single-leading-shoe Lockheed mechanisms are used all around. The handbrake intrigues because it makes the rear end dip when used to slow the car, and because you can adjust it for either rear wheel from the driver's seat. We experienced no brake fade whatsoever during our test, but the freezing temperatures were all on the side of the brakes.

WHAT'S IN A NAME?

The 850 is an extraordinary car. Perhaps because it is one man's design rather than a "group-think" project, it comes across as a singular and strong personality. It is therefore disappointing that BMC has not managed to find one good name for the car and stick with it. Over there they call it Morris Mini-Minor or Austin Se7en (sic)—it's made both at Abingdon and Longbridge, to satisfy the very partisan buyers and sellers of the traditionally competitive Morris and Austin lines. In the U.S.A. they are to be known only as Austin or Morris 850's. Unfortunately nothing came of a promising plot to tool up a special grille and nameplate for a single U.S. version of the car. For the time being American dealers will have to suffer along with one of the more antiquated byproducts of British marketing.

QUALITY

Technically, this is a quality car. That is, the design is well-balanced and successful. It's designed to sell for a price so there's none of the British gimmickry of genuine leather or walnut veneer with a mediocre car beneath. From here on, it's up to BMC's production crew to make sure the construction is up to the design.

The car's only major design failure is parking vulnerability. The bumpers are dinky and far too low, while the bumper guards barely protect the 850 from an angry Volkswagen. We would like to suggest that BMC act now, rather than after 4000 complaints have rolled in, to correct this. The shape and height of the grille's top bar would make it easy to install a matching bumper guard. With this in place an 850 could, if the hand-brake were set firmly, fend off an angry Oldsmobile without loss of face. Our test car took quite a beating in routine urban parking.

WILL IT SELL?

Ever since the first post-war Austin landed on American shores, each new small car design has been welcomed with, "It won't sell here." Some have overcome the experts' pronouncements but many have not. Europe's rose is sometimes America's dandelion, for our requirements differ. The 850 may bloom and it may wither—which will tell us more about our fellow countrymen and their needs than about the 850 itself. And Americans have become increasingly perceptive about transportation lately, as Detroit well knows. —SCI



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To Europe's
Races In
Style

from page 56

As for the famous autumn European automobile salons, again this year Scandinavian Airlines offers three "Show Tour" packages. These were originally planned for dealers, but anyone can go. As there is no Frankfurt Show this year, the longest tour — which lasts just over four weeks and costs roughly \$1,150 — takes in the early-October Paris Show, the late-October London Show and the early-November Turin Salon, the time between them being spent in typical tourist travel across the Continent. The \$680, two-week tour omits the Turin Salon, and the third alternative is a 10-day, \$675 jaunt to the Paris Salon only.

Alitalia Airlines plans to offer all three kinds of tours this year — trips to the races, car-purchase plans similar to both the Rootes Group and the various car-club tours but in collaboration with various Italian car manufacturers, and a special Automobile Show tour as well.

Although it is obviously not in Europe, it might be worth mentioning that, along with special trains and planes which run from various midwestern cities to Indianapolis for the Memorial Day 500-Mile race, NATIONAL SPEED SPORT NEWS, (The News Bldg., Ridgewood, N. J.) is planning a charter flight from the New York area to the Sebring Grand Prize next December, similar to the flights they have sponsored for the March Sebring 12-Hours for the past five years. It costs around \$105 round trip. N.S.S.N. will also make \$5- to \$7.50 per night reservations for you in a private home in Sebring, a town which has nothing like enough public accommodations to handle a race crowd.

A few last points with reference to your trip and/or new car in Europe. Never mind anything you might hear to the contrary. Unless you have some really fantastic connections in Europe, it is better to make rental or car-purchase arrangements before you leave the U.S. If you don't, there's a chance that you'll find you can't get the car you want when you get to Europe.

How much money beyond the cost of your car and tour do you need? Depends on how big a spender you are. If you are what might be called a frugal traveler, and you're taking one of the "everything included" kinds of tours, you should be able to manage with an extra \$100, presuming you don't over-tip and can consistently resist temptation of the ever-present "extras." You might keep in mind the old travel cliché of "take half the amount of clothes and twice the amount of money you think you'll need."

Lastly, whatever organization you choose to make your travel arrangements will give you all the information you'll need about passports, touring papers, licenses and, as they probably don't yet say in Europe, all that jazz. *Tout ce jazz? Tutto questo jazz? Alle dieser Jazz?* Well. —DMB

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Three Who Thought Things Through

from page 65

THE BARE BLUE BODIES

The Echidnas all use the standard Devin fiberglass body unmodified. The body takes no stresses, simply resting on the extremely rigid frame. (Larson: "It's a canopy, not a bulkhead.") The finish, a relatively pale blue paint job on all three cars, is superb and often the subject of questions from others familiar with fiberglass bodies. "The Grierson magic touch," is Staver's stock reply.

Instrumentation on the Echidnas is extremely limited. None of them sport an oil temperature gauge, for instance. "We've checked during preparation what the oil temperature is—it's fine," says Ed Grierson.

All three have tachometers. Staver's and Larson's cars have oil pressure gauges but Grierson takes a confident builder's delight in pointing out that his dashboard carries only a warning "idiot" light for oil pressure. Remaining dashboard fixtures are from the junked passenger cars, including starter buttons for horns. The much-admired, spring-loaded hold-down clips for keeping the hood in place are, the trio assures everyone, called "grummnovitches." Staver obtained them from Scaglietti in Modena by stamping his foot and shouting.

The basic 1955-57 Chevrolet passenger car ancestry is further exploited through a range of small considerations often overlooked in planning your own car. The following items not mentioned previously are all from the junked sedans: horns, emergency brakes, master cylinders, clutch parts, pedals, firewalls and their body mounts, light switches, ignition switches and keys, warning lights, and junction boxes. The throttle linkages are standard passenger-car, popping through the firewall at exactly the right spot for connection with the fuel injection systems.

THE RACING RECORD

The first race for the Echidna was at State Fair Park in Milwaukee, May, 1958, in an SCCA regional event. Practice period was the first time there had been any opportunity to drive the car on a circuit. Acceleration of the 283-cubic-inch-engined car continued to frighten Staver over the weekend. As he remembers his first excursion, "With a far-too-low 4.11 rear end, the driver was in complete awe." But it performed without failure despite "unbelievable rear wheel windup and a complete inability of the driver to downshift properly due to the wrong wheel position." He won his class against little opposition.

For the Road America June Sprints a few weeks later, the rear end cog was raised to 3.70. "Driver still in awe," reported Staver. He finished eighth overall and third in CM in the National race to the Cunningham Lister/Jags—but very few people noticed.

At two subsequent regionals (Bloomington and Eveleth, Minn.), with Staver and Grierson driving, the Echidna took a second to Don Skogmo's D-Jaguar, notched

(Continued on page 86)

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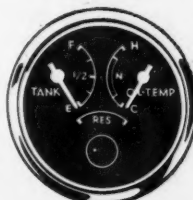


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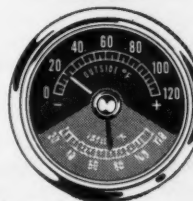
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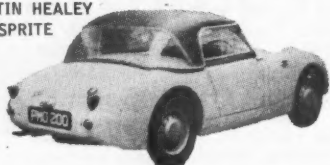
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(Continued from page 85)

up a DNF due to a cracked gearbox cover, and beat the D-Jaguar twice. At the National Road America 500, the car rested second in class to the eventual winning Ferrari of Reventlow/Andrey at 250 miles when pebbles got into the air orifices of the injection nozzles and chopped power by 60 percent. Much time was wasted in the pits, the car eventually returning to the fray with the trouble uncured, taking a fourth in class and a twelfth overall with over 400 miles of racing.

At the SCCA Meadowdale inaugural in September, Staver took a fourth in a preliminary. In the final, the Echidna was admirably conducted by Staver into a first in class and a fifth overall to the two Scarabs, a special, and an RS Porsche. Just a few people started to notice.

THREE FOR '59

The 1959 lineup of one B and two C cars had to wait until late June for a race near enough for them to reach with ease. At Road America again, Grierson's car was left at the hotel and the effort was concentrated on fielding the other two. It was well worth it. The "bare-foot boys from north of Duluth" got Bill Larson's car into a fourth in class in the 140-mile feature behind Constantine's Aston and two D-Jaguars. Staver's bigger job finished second in BM to Windridge's overall-winning Lister-Corvette. Some more people started to notice.

Three regional races at Bloomington and two at Sioux Falls, S.D. followed. They saw the Echidna design jell as the three drivers brought their cars in one, two, three in varying order in all but one of the five sprints. The one miss was a DNF due to a fan belt failure. Impressively the odds-beater, rapid Dr. Larson, took first overall in his less potent model in both regional feature races.

At Meadowdale on Labor Day even the myopic followers of the sport sat up and noticed the Echidnas. The three cars entered the double-heat "Formula Libre" event and made a big impression. Larson and Grierson had some dandy battles with three- and four-plus liter Ferraris, D-Jaguars, Lister-Corvettes, and John Fitch's Cooper-Monaco. Larson was brilliant as he took two fourths and the same overall position. Grierson was nearly as neat with a sixth and a seventh in heats and a sixth overall—very much up in the USAC prize money. Staver's Echidna was even more impressive although not around at the end due to a \$1.25 fuel injection drive cable snapping. In the first heat, he fought off Jim Rathmann's potent Lister-Corvette throughout for a third behind Pabst (Scarab) and Lloyd Ruby (4.5 Maserati).

At the Road America 500, Larson and Don Skogmo shared the former's car. It rested tenth overall at half-way and fourth in class to such opposition as the two Lister-Jags, the Constantine/O'Shea DBR-2, and the Connell/Hudson 4.1 Ferrari when an undetectable radiator hose collapse led to its eventual retirement. Staver and Grierson had a delightful and devastating six-hour run for the full distance in B Modified, easily trouncing and outlasting their opposition in this, the longest amateur sports car race, for a first in

class and a seventh overall. Both cars were consistently over Elkhart's 80 mph lap mark. Now, everybody noticed.

Finally, at the regional "Oktober Rennen" meet at Road America last October, Staver's single Echidna entry ran away from the field in the 60-mile feature. Principal opposition was Pabst's much-modified Bocar which Staver had to take twice due to a spinout.

SUMMARY AND LESSON

The Echidna story provides a significant commentary on the efforts of many "who want to go racing." It carries its own moral: There is an awful lot of eyewash being foisted on the racing fraternity about competition machinery—much of it of their own contriving, presumably as a matter of self-justification. An examination of the Echidna project in depth provides no other conclusion. It is a devastatingly straightforward approach to fielding a winning car at modest cost and without a fraction of the agony in which such ventures normally wallow. And, very important, three men—having built the cars entirely by themselves—are having an enormous amount of fun driving what they built.

Oh! That name—Echidna. You have been patient and the three desperate iron miners have agreed to release the facts.

Once upon a time, early in 1958, the subject of a name for the design arose. Staver had planned this conversation and, impressed with the "threesome" aspects of the undertaking, immediately suggested "Triad." Now, it is a matter of faith among these three that you must never agree to anything either of the others suggests—always argue. Grierson and Larson filed resounding "No's" to Triad.

For his turn, Larson recalled their claim of "the most northerly sports car builders in the world" and suggested that a lovely name would be "Borealis." Nice name but in their firm tradition, the other two denounced it out-of-hand. It was Grierson's turn but he turned contemplative and offered to present his suggestion in the morning. The suspicion was he couldn't think of a thing to say.

At home that evening, mulling over his problem, Grierson was shuffling the recently-arrived photographs from Bill Devin of the bodies which had just been ordered. Describing his problem to his wife, he showed her the pictures. Now, Marilyn Grierson was something less than wildly enthusiastic over the prospect of three "monster" sports cars being constructed in her backyard. But in this case she offered the essential ingredient of being a crossword puzzle fan. Scowling at the pictures, she came to a profile of the long-nosed Devin body and asked, sarcastically, "Why don't you call it an echidna?" Baffled, Ed soon learned that an echidna is, you will pardon the expression, an Australian anteater (long-nosed) and a crossword puzzle standard. He offered it the next morning amid groans from the other two and the usual compromise was achieved: The team's shield is triangular in shape (Staver's Triad); a snowflake adorns the top portion (Larson's Borealis); and the word spelled out to form the base is—very often mispronounced.

Correctly, it rhymes with Heck, did ya? Yes. They did. —DvdF

Lotus Seven America

from page 31

the handbrake is hard to get at, being away on the passenger side of the car. The view out over the long hood is inspiring, even taking in the brightly twirling knock-off nuts that stand out from the Lotus's narrow fenders.

The pedals are less inspiring. We'd suggest following the ancient Chinese custom of binding your feet for a few years before tackling this particular car. With skill it's possible to get a 9C shoe on the necessary controls, which feel about the size of a half-dollar. You find that your right foot just about covers both the brake and accelerator, so you control by rolling your foot to one side and the other instead of actually moving it sideways. This of course makes "heel-and-toe" work a cinch, but it can lead to application of the wrong pedal at the wrong time.

When the engine was fired up and the car put on the road, we found that the Seven cleverly combines a traditional sports car feel with the most modern techniques of frame design and suspension. It has amazing cornering power, thanks mainly to its extremely stiff space-framed chassis.

In this day and age the use of a live rear axle causes raised eyebrows in some quarters, but in the Seven this heavy assembly is so well located that you're seldom

if ever aware that it's there. Whenever the tail can be broken loose — which is really only on wet roads — it does so very smoothly and controllably.

Light weight is as helpful for braking as it is for acceleration and handling, and on the Lotus Seven fantastic retardation is provided by very modest pedal pressures. The standard linings show no tendency to fade in normal road use, and even after a series of panic stops from speed they continued to halt the car squarely without any increase in pedal travel.

With its 4.875 axle ratio, the test car was obviously set up for acceleration rather than maximum speed, and it certainly did deliver far more sparkling performance than the Sprite engine provides in its original resting place. In top gear the most this engine will pull in the Lotus is 5500 rpm, which corresponds to only 81 mph — about what most Sprites will do, but the Lotus gets there a whole lot quicker.

For road use, however, extra speed is worth little unless you're keen to tangle with the police, and the Lotus provides all the exhilaration at 60 that some more lavishly equipped sports cars supply at 100. In fact, on a cold, dark winter's night 70 mph can feel like 140! There's nothing like it for blowing away the cobwebs of a city office.

The weather protection of the Seven can be summed up by saying that it would impress a motorcyclist but not a Jaguar owner. The simple canvas top is held in place by tubular supports and is clipped down all around by Dot fasteners. When not in use it's stowed behind the seats, and

it's fairly easy and quick to put up or down. When it's up, the Seven looks much better than do most roadsters with their canvas flying. But getting in and out under these conditions requires considerable agility, practice and a slender frame as well. If you weigh much more than 180 pounds you might as well forget it; you couldn't get your thighs past the steering wheel. It's like climbing into a frozen sleeping bag with a wooden leg. The best way to manage it is to leave the three right-hand windshield snaps unfastened, then reach up and hook them to the pegs after you get behind the wheel.

Despite all the shortcomings mentioned, the Lotus Seven has a remarkable attraction for enthusiastic drivers because it's far less of a compromise than are most sports cars today. Basically it's a racing car which can be used on the road without any of the snags normally associated with sports-racing machinery.

Yet roadholding, steering and braking are right up to racing car standards, and the instant steering and speedy gear shift all contribute to sheer driving pleasure. There are a lot of standard parts built into the Lotus Seven, but the chassis they're all attached to makes them seem a lot more desirable than they were in their parent vehicles. With the emphasis on competitive performance, it's hard to view this as a true all-purpose sports car unless you're a dedicated enthusiast — a *small* dedicated enthusiast. The Seven America is a genuine male automobile, tough, muscular and utilitarian.

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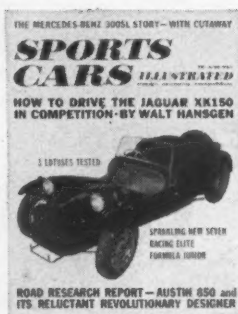


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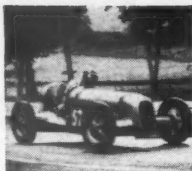
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The Reluctant Revolutionary

from page 45

Foundation of the chassisless Lightweight was a pair of long, deep cheeks made in sandwich form from five-ply wood complexioned on both faces with aluminum sheet. These members were buttoned together by the engine itself, the firewall, several light-alloy cross tubes, the seat pan, the differential housing and an exquisitely-faired prow cowl enclosing both the radiator and the front suspension. The only nonstressed item on the Lightweight, it used to be said, was the upholstery. You couldn't dispense with upholstery altogether, so cloth was used instead of the customary leather, to save weight.

Suspension was independent all around, with swing axles, rubber bands in tension and long fore/aft radius arms at the back, transverse links and rubber in compression in front, the latter enclosed in a cross tube. Dry weight being an almost incredible 587 pounds, keeping unsprung mass down was a major problem. To help beat it, special wheels were built with magnesium alloy centers and rims, the latter with countless peripheral drillings for lightness. Steel brake drums were pressed in. Brake operation was originally mechanical, by cased cables, but later the system was converted to hydraulic. Wheelbase measured 86 inches, treads were equal at 50 inches.

For a propellant, possessing nothing better Issigonis intended to use the Ulster engine he'd salvaged from his old Seven, but before this *mesalliance* became reality, news of the project reached the ears of Tom Murray Jamieson, who was in charge of racing design and development at Austin's Longbridge headquarters. Jamieson came, saw, was conquered; he then went home and honeyed his master, Lord Austin, into issuing Issigonis with all the parts necessary for the conversion of his existing engine into a facsimile of the latest factory sidevalver. This one having recently been redesigned almost from pan to head, what was left of the original Ulster unit after the merger was accomplished didn't amount to much.

This was the only case on record of Austin giving an independent so much as a smell at any equipment in contemporary use on the team cars, so the implied tribute was unique, terrific.

WW2 broke out soon after the Lightweight became ripe for racing, but not too soon to prevent Issigonis giving a few practical demonstrations of its phenomenal performance and advanced handling qualities. Aided on standing-start getaways by its low-period i.r.s. and the resulting absence of weight shift between opposing driving wheels, it repeatedly left the seventy competition for dead in the climbs and sprints for which it had been exclusively designed and developed. Once, as a crowning glory, it beat one of the hitherto almost invincible works Austins in an important climb at Prescott, Gloucestershire. "Even I could drive it without

frightening myself," recalls Issigonis modestly.

Perhaps incapable of true relaxation, Issigonis seemingly isn't happy unless he's as busy as a valve spring. He smokes cigarettes fast and much, talks in staccato rushes but quietly and with invariable courtesy, has a love of paradox and can be epigrammatic without pausing to reach for his shafts. He is an habitual worrier and practically never gets B.M.C. business off his mind, except maybe momentarily when indulging his one real hobby, namely, steam. Monday through Friday, he operates at Longbridge, on the Austin end of the B.M.C. axis, and out-spans at a Birmingham hotel. On Fridays he's based on Cowley, where he has a second office, and spends his weekends with his mother at their flat in Oxford, a couple of miles from the Morris factory.

Although cars designed by Issigonis, notably the perennial Minor, have earned dollars by the million for the corporation he serves, he has never visited America and declines to do so. Life as he visualizes it in U.S. cities is not, he thinks, exactly his speed, but on the other hand some of his best friends are American and he derives the greatest pleasure from their visits, company and stimulating viewpoint.

In the thirty years he's been associated with Britain's car industry, starting with a six-year stretch at Humber, working on chassis and suspension development, none of Issigonis's projects have been classifiable as failures. There was one in particular, of more than passing academic interest, which came to nothing in spite of intriguing possibilities, due entirely to economic obstacles at the time and on the firm in question. This was a V8 he designed for Alvis during a three-year spell there in the mid-fifties. Of 3 liters capacity, the engine had an aluminum alloy block and heads, single o.h.c. to each bank. Issigonis himself, out of respect for Alvis's wishes, is reticent regarding further detail, apart from saying the whole car was built to very compact dimensions, but observant persons who claim to have seen the prototype during testing sorties, and who attempted to stay in its slipstream, were quoted at the time as saying their endeavors were thwarted with contemptuous ease the moment the tester stuck his foot into it.

Other stillborns on the Issigonis dossier were of course the experimental flat-four engines tried in the original prototype Morris Minor—800 cc for the British market, 1100 cc for overseas. Both were sidevalvers with iron blocks, aluminum heads, oversquare proportions, identical strokes but differential bores. They hadn't any screaming pretensions, the outputs being designedly moderate, but the idea was to gear them high (3.9/1 axle ratio on the bigger job) and endow them with tremendous longevity. Tooling cost considerations beat the flat-fours when it came to deciding between them and the serviceable if pedestrian in-line side-valver left over from the prewar E Series Morris Eight, and the latter won the verdict.

"Safety", says Issigonis, "is more important than comfort." This is something racing teaches you, and it conditions your

(Continued on page 90)

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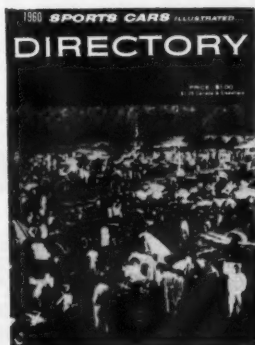
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(Continued from page 88)

thinking when you come to designing passenger cars. Nonetheless, he insists, racing does not in any direct or tangible way improve the breed. In its day, the Lightweight Special was an outstandingly roadable racing car, and the small B.M.C. front-drivers are, in their day, outstandingly safe and roadable passenger cars, but there is positively no material affinity between the two designs. They have all-independent suspension and monocoque construction in common, true, also rubber as the springing medium, but the applications are totally different.

As a detached observer of modern racing design, Issigonis admires the blacksmith school, typified by Cooper, rather than the scientific. To satisfy the academic mind, practice has to walk obediently in theory's wake, and when it doesn't, which is often, the theoretician's ego is hurt. Cooper, on the other hand, will for instance provide three alternative pickup holes for a staple suspension component, and if the first doesn't give a geometry that works, one of the others will. "I love that kind of engineering", enthuses Issigonis, the paradox lover who, when he himself designed a racing car, was acclaimed as the prophet of rationalism and the scientific approach . . . To confound your mental confusion further, he is also liable to express seemingly sincere regrets for the passing of "the good old days of separate chassis and wood-based coachwork."

The rigid front axle, he goes on to assert, was certainly ditched in too much of a hurry. To this wholesale innovator, whom the hyperbole-shunning AUTOCAR has classified as revolutionary, novelty for its own sake makes no sense. If a conventional usage works, that's its own justification, and any unconventional substitute that may be proposed has to prove itself unmistakably superior before he'll thaw to it. His practice *vs.* theory philosophy, cited above in the racing context, is a guiding force in his passenger car work, too. The place to find out, and fast, whether a new idea has something, is on the road in rough prototype form, rather than on paper and in scholarly debate at technical meetings that merely breed other meetings. By the same token he is "never impressed by numbers" and proves it by keeping his own staff small: he has only about six key men working under him at B.M.C.

A handout issued at the press launching of the Austin and Morris 850 last August opened with these words: "Some of you may be appalled by the unconventional features which you see in this new model". With something less than reckless boasting for a fundamental feature of these dainty debs, the bulletin went on to describe the combination of front engine position and front-wheel drive as the better of two evils. These were phrases it would be hard to imagine issuing from the typewriter of any automotive press officer ever born of woman. Unsigned as it was, the sheet was recognizable at fifty paces as the handiwork of B.M.C.'s reluctant revolutionary and *enfant terrible*, Mk. 1, Alec Issigonis himself, unedited and unexpurgated. The scribes found they weren't appalled but it made a pleasant change to be told they might be.

—DM

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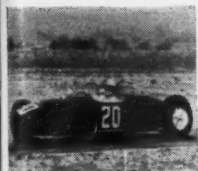
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Lotus Formula 1

from page 37

The front chassis bay extends rearward to the cowl hoop, which is a tubular and sheet structure designed to eliminate the necessity for diagonal bracing, and at the same time to provide mountings for steering column, instruments, switches, gear-lever, handbrake and seat. Forward of the cowl the frame is a fully-braced structure, but the next bay to the rear — from the cowl to the engine bulkhead — is only braced on three sides, and only becomes torsionally rigid as part of the complete chassis, drawing its stiffness from the structures to the front and rear.

NEW SUSPENSIONS

The lower rear suspension mountings are situated immediately above the apex of the two bottom frame tubes. As the upper suspension links are the drive shafts, the pivot points in this case are the universal joints at the inner ends of the shafts. The spring-shock units are located by brackets mounted off the top corner of the triangular rear frame. The top member of this frame acts as a beam, with suspension loads fed into it at both ends and engine loads reacted in the center, the gearbox casing being located at this point by two rubber-cone-bushed mountings. Fore and aft suspension loadings are taken out into the chassis through parallel radius arms anchored on both sides at the top and bottom of the engine bulkhead.

"Double transverse link" is Colin Chapman's title for the rear suspension. Due to the configuration of the layout very little tensile or compressive load is taken through the drive shaft, so that although it is structurally a suspension member it is not overworked. Each hub casting houses two deep-row ball bearings of sealed type, as opposed to last year's taper-roller bearings, and is extended downward to provide a connection for the lower radius arm (the upper radius arm is located just above the drive shaft) and the outer ends of the lateral links. These are threaded at the inner end for alteration of camber angle and at the outer for adjustment of toe-in.

The chief reason for adopting this new rear suspension layout is that there is insufficient height at the rear for the installation of the Lotus strut-type suspension. The cast rear wheels have been redesigned to give a better standard-section rim and complement the overall suspension design.

The front suspension is derived from the wishbone system fitted for the past three years on all Lotus models except the Seventeen. The latest developments include the substitution of a tubular top wishbone, with a threaded ball-jointed outer end — to allow adjustment of camber angle — in place of the composite structure of top link (with fixed outer ball joint) and anti-roll bar. In the new layout an anti-roll bar is still used, but positioned slightly

(Continued on page 92)

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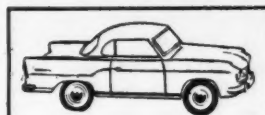
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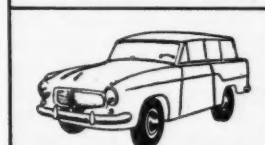
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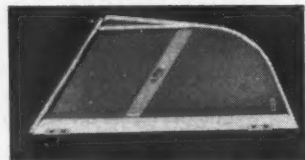
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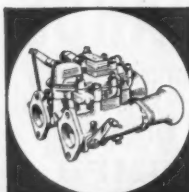
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(Continued from page 91)

lower and to the rear of the wheel centerline.

The machined steel hubs, proprietary (Standard—Triumph) uprights and bolt-on cast magnesium front wheels are all as on last year's car. However the bottom knuckle joint will have a nylon bush bearing instead of the screwed steel bush used previously. The suspension units, incorporating Armstrong adjustable shock absorbers, are also similar to last year's but the springs have been redesigned in view of the different weights involved.

As last year the front brakes are 10½-inch Girling discs, mounted outboard. The 9½-inch rear brakes will ideally be mounted inboard, but under special circumstances, such as on the all-acceleration-or-braking Monaco circuit, they may be mounted outboard. Provision for this is made in the rear hub castings, and it is possible for the calipers to be assembled either ahead of or behind the hubs.

POWER AND GEARING

The engine is basically the latest 2495 cc four-cylinder, 3.70 x 3.54 inch Coventry Climax FPF unit, which develops 239 bhp at 6750 rpm. Surprising as it may seem, Coventry Climax makes no provision for the fitting of tachometer or fuel pump drives, but Lotus takes the former from the front of the exhaust camshaft and the latter from the rear of the intake camshaft.

Bolted directly to the engine is the Lotus five-speed gearbox/final drive unit, basically in the form developed for the Lotus Fifteen which ran at Le Mans last year. The front casting has been redesigned to incorporate the clutch bell housing, clutch throw-out mechanism, starter mounting and Bendix housing and the whole unit is incredibly compact—even more so than on last year's cars. The gear trains are mounted behind the rear-wheel centerline and the drive, taken through a Borg and Beck twin-plate clutch with sintered copper linings, enters the box underneath the differential unit. Hypoid-bevel final-drive gears are used and the unit has its own lubrication system, unlike last year's setup when the transmission, with spiral-bevel final-drive gears, ran on engine oil.

In addition to being far more compact, the 1959 sports car box offers almost unrivaled facilities for alteration of gear ratios; it is only necessary to remove the rear cover, which is attached by nine bolts, and slide the gears out. First and second gears are fixed, while seven pairs of gears are available for third, fourth and fifth giving a total of fourteen alternative ratios. Final drive is fixed at 4.1 to 1 and therefore it is customary on fast circuits for both fourth and fifth gears to be over-drive ratios.

A further refinement is the provision for lateral adjustment of the ring gear by a threaded bearing housing in place of the shims which were used previously.

The method of shifting gears has altered somewhat since the five-speed gearbox was first introduced. Selection was originally made by a lever which was moved forward for upward changes and backward for downward changes, but always returned to a central position. On the current boxes a migratory lever is used, positive

selection being ensured by a series of stops on a pair of racks—one controlling upshifts and the other downshifts. The gears themselves are engaged by the selector sleeve, which is splined to the input shaft and is provided with external dogs which engage internal dogs on the gears. Each pair of gears is in constant mesh but only the pair receiving the drive through the selector sleeve actually transmits it, through the output shaft, to the ring gear and pinion. In the light of experience the selector mechanism has recently been made somewhat stronger.

FUNCTIONAL BODYWORK

In the Lotus tradition the new F.1 car has a light fiberglass-cum-tubular-steel seat of form-hugging shape which is very rigidly mounted. Last year the shape of the seat was somewhat controlled by the shape of the gearbox, but on the new car it's possible to have a seat pan profiled for individual drivers. There is also adequate room in the cockpit for shoulders, elbows and knees.

As already explained by Colin Chapman, the body shape has been designed to obtain minimum frontal area. The elliptical cross-section of the 1959 car has been abandoned in the interests of chassis stiffness, but any increase in drag coefficient should be more than counterbalanced by the marked reduction of frontal area. And with an exposed-wheel layout, tire sizes being extremely large for such a small car, it is doubtful whether body drag will make any appreciable difference in maximum speed. From this angle it will be very interesting to see how fast the new Lotus goes at Rheims. All body panels are quickly removable, and it's probable that on future cars even the undertray will be Dzus-fastened, tubular members being incorporated to take stress loadings.

Having enclosed all the major components, Chapman was faced with the problem of fitting some 30 gallons of fuel tankage without any increase of frontal area. This has been achieved by locating a massive tank over the driver's legs, with a smaller tank tucked in behind, and to the right of, the seat. The plan is to run on the front tank until ideal handling is obtained, then switch over to the center tank—maintaining a virtually constant weight distribution—for the rest of the race. Space also had to be found for a 6 gallon oil tank (4½ gallons of oil and 1½ of air). This was eventually made triangular in shape and mounted immediately behind the radiator.

Vital statistics of the new car are 90-inch wheelbase, 49-inch front tread and 47½-inch rear tread. Dry weight is approximately 770 pounds. Starting line weight, with 270 pounds of fuel, 180 pounds of driver, 50 pounds of oil and 20 pounds of water will be considerably higher, but still lighter than most of the opposition. Weight distribution at normal ride level is 56 percent rear, 44 percent front.

Although the Fifteen had a good record in English races, and the Elite was almost unbeatable in the 1300 cc GT class, Team Lotus had a poor season in 1959. It was this which prompted Colin Chapman to take a clean sheet of paper to start on his 1960 designs.

—DP

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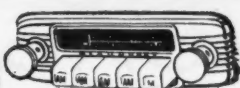
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Panhard PL17

from page 60

trunk." Equally true, and again the PL17 takes full advantage of the possibilities. This is a point where rear-engined cars cannot keep up, because the wells around the sharply turning front wheels encroach on a front trunk. A bonus on the Panhard is the removable rear seat.

"F.w.d. engines are easy to cool, especially by air, and they do not get road dust thrown up by the front wheels." This is also a truthful dig at rear-engined cars. In fact, the Panhard had a shrouded blower fitted only when it became necessary to have a satisfactory heater/defroster for export. The latter, incidentally, is standard even on the stripped \$1797 "Grand Luxe" model. (It should be called Petit Luxe, perhaps?)

"A very direct column-shift can be fitted, giving the advantages of a clear floor without the too-frequent disadvantages of a sloppy mechanism." This is an f.w.d. exclusive and it's based on the gearbox's being close to the front wheels where the steering column ends. The Panhard's shift is not satisfying, but it's not the linkage that's at fault. Much of the difficulty evidently lies in the synchromeshing, as double-clutching and matching revs made each shift as smooth as silk.

"F.w.d. gets you through a turn faster."

This is the heart of the long-lived f.w.d. controversy. It is easy to prove on paper that this is true: the essence of the argument is similar to the advantage on slippery surfaces; the power is pulling you towards the center of the turn rather than driving you only tangentially. However, current theory about cornering, based on the slip angle concept and substantiated by careful scrutiny of racing cars in action (on dry pavement) indicates that rear-drive cars enjoy the same advantage since their back wheels "hang out" when cornered vigorously. A counter-claim is that most f.w.d. cars feel so bad cornering on the over-run that you do indeed corner faster, but only because your throttle foot is down flat in self-defense. Our feeling at SCI is that super-fast cornering is more dependent on close liaison between driver and tires than any other single factor. Cars which satisfy in this respect can corner faster than others even though deficient in such matters as weight distribution, power, or even quickness of steering.

The upshot of all this is that the claimed practical advantages are true, though many are equally true of rear-engined cars. The two major items involving handling are likely to upset a few prejudices, so we took the Panhard to SCI's Road Research Test Circle in order to explore its cornering characteristics as carefully as possible.

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(Continued on page 94)



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(Continued from page 93)

tively easy to maintain a test car in a particular cornering posture long enough to make suitable observations. After first noting tire pressures, we drive counter-clockwise around the circle, noting the steering wheel position required to maintain various constant speeds in increments of 10 mph. The most trying effort from several standpoints is to note the highest speed attainable and whatever action is required at the helm.

In the graph of Steering Behavior, the steering wheel is shown at the position necessary for maintaining 10 mph, with the mark at "three o'clock" or rather where that has moved to. How far it has moved is, for want of a better term, called the "Ackermann angle" in honor of the gentleman who designed a steering linkage that did not keep the front wheels parallel during a turn. This is a simple measure of the steering quickness. The spacing of the 20 and 30 mph marks shows the increases in lock required. This is a rough-and-ready measure of the strength of the car's understeer characteristics. Whether the car has final over- or understeer is shown by the location of the 40 and 50 or higher marks.

In case anyone thinks that this Steering Behavior graph is the be-all and end-all of analyzing this interesting area, let us be the first to claim "not so." It is only a beginning, one which we sincerely hope to follow up as time and resources allow. Readers' comments will, as always, be welcome.

PANHARD ON THE CIRCLE

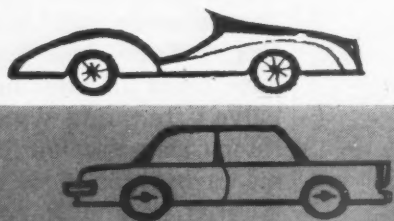
The Panhard Owner's Manual suggests 19 and 24 psi for front and rear tire pressure (17 and 23 psi with Michelin X, which are standard only on the 60 bhp Tiger models). When tested with these pressures, the Panhard was a definite and deliberate understeering car as long as power was "on." The Ackermann angle

was some 39° at the steering wheel and each 10 mph increment in speed required about 6° more lock. As you can see from the close spacing of the marks on the Steering Behavior graph, the Panhard is a mild understeering car with very quick steering. After 40 mph, though, further increases took proportionately more lock, some 70° being needed at the maximum of 52 mph, indicating that with these tire pressures the Panhard is now understeering rather strongly.

Our next step was to raise the pressure in the front tires equal to the rear ones, making suitable allowance for the rise in temperature which had occurred due to cornering. The effect was to just perceptibly quicken the steering (the Ackermann angle was reduced 2°) and dramatically reduce the understeer. So much so that the wheel position required to hold the car at 20 mph now sufficed for 40 mph. The maximum attainable speed remained the same at 52 indicated.

The final arrangement was with the rear tires raised to the equivalent of 30 psi cold, giving a front-rear ratio similar to the original 19/24. The Ackermann angle was unchanged, from which we might conclude that it is affected only by front tire pressure and steering geometry. As speeds were increased, it was found that the car was understeering more than in the second stage, though not as much as in the first. The surprise came above 50 mph. It was possible to indicate 60 mph, but now traces of oversteer appeared. Some 5° less lock than at 50 mph was needed, though we must admit that this wasn't really and truly a "steady state" condition, as we were rather busy moving the wheel back and forth.

Readers who are interested might like to make arrangements at local airports to establish Test Circles of the same size as SCI's and conduct tests on their own cars. Tests on the same car on circles of



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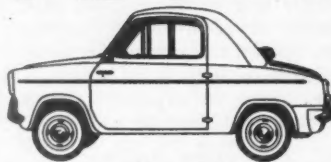
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differing sizes would be interesting too.

PANHARD PL 17

Large as its doors are and big as the cockpit is inside, entry is none too easy. The front doors hinge at the rear and swing up as well as back. The door stay has several "click-stops" to hold it open but at the widest position, the gentlest brushing of the door with your back will slip it off the catch and let it swing down on you, prodding you with the pointed window-wind handle. Discussion of these rear-hinged doors is fairly academic, as the French government has decreed that no cars introduced in the future may be so equipped.

Once sitting on the bench seat, the spaciousness is tremendously impressive. The floor is quite flat; there's not even a hint of a tunnel. The dashboard seems a yard away and has no knobs or projections at all. Three compartments lie below its fabric-covered cylindrical shape. All instruments and controls are carried in a large plastic console that juts aft from the dash, surrounding the steering column. It is creamy white and though it keeps the instruments themselves from reflecting in the windshield at night, the dash lights or sun illuminate its plastic tier and they reflect in the windshield very clearly and strongly. A simple cure would be to paint the console flat black.

The speedometer has a circle on the needle instead of a point. Other instruments include ammeter, fuel gauge and total and trip odometer. The latter can be reset to zero by pulling a plastic bobbin out from the right side of the console; it is attached to a string which does the reset. An oil pressure light in the center of the speedo flickers at idle.

The accelerator pedal is nicely slanted off to the right, just like one's right foot, but there is nothing else about it that we enjoyed. Undoubtedly the super-flexible mounting of the engine makes designing a good throttle linkage difficult, but it seems a nadir of imperfection has been achieved. When you close the throttle abruptly, the car naturally decelerates just as one would expect. But as it does, it makes the engine rock on its mountings, moving the carburetor towards the accelerator pedal. So a moment after the engine starts "braking," its throttle cracks open a bit and the car seems to surge forward. It's disconcerting at first but one gets used to this sort of reaction from the Panhard for it's definitely one of those cars that has a mind of its own. The Panhard is a large metal container on wheels for transporting six people (maximum) at minimum expense. It makes no pretensions to being a luxury car, though more luxurious appointments are available. It is no racing car, though 10 extra hp are available and the D.B. derivative is available too. It does offer economy, though in the chill of mid-winter we were hard put to exceed 30 mpg, and it will pack in six people and/or considerable luggage. For economically covering long distances with large loads, it successfully exploits the advantages of f.w.d., but most of its drawbacks are those that could be found on any car. They deserve attention.

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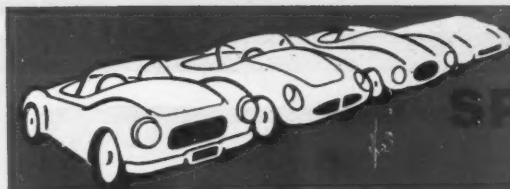
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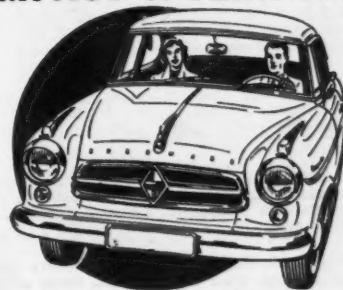
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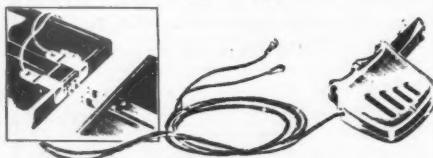
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98/SPORTS CARS ILLUSTRATED/JUNE 1960

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The Least For The Most

from page 66

The following day he was back with rough drawings for a kart-size streamliner. "If we're going to take a little machine," he said, "let's go fast with it. I can build this but I wouldn't do it around a production kart chassis; it wouldn't be up to the speed that a shape like this would want to move at. But we can use some kart components and let's start with your engines." Orndorff's employer liked the idea and volunteered engines and any other kart parts that might be required.

Schapel detailed the car, then obtained the entry blank and rules for the Nationals, found that his radically different machine was at odds with many of the event's technical regulations. After considerable haggling the Nationals' directors were satisfied on all points with the exception of tow-starting the vehicle rather than push-starting it. About six weeks before the annual speed conclave on the Salt Schapel began building the car.

The car's steering was taken from a Fiat 500. Its unsprung, live rear axle was mounted by means of a pair of self-aligning ball bearings bolted to the frame. For the front end Schapel built a low-pivot swing axle similar in layout to that of the J2X Allard.

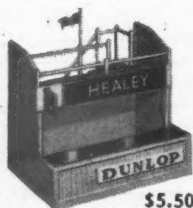
For a power source Schapel used a pair of Power Products two-cycle engines, as used in Rocket karts. With a total displacement of 16.4 cubic inches and an output of about 14 bhp these were theoretically capable of propelling the little streamliner at 140 mph at 7360 rpm. They were cooled by air ducting, the ideal openings for which had been determined by wind tunnel tests and by photographing the readings on banks of manometers inside the car which recorded the reactions of pressure heads on the body's skin. Chain drive transmitted the power to the rear axle, and the 2.67-to-one final drive ratio, plus absence of change-speed transmission, required an assisted starting speed of no less than 60 mph.

This was the cause of the little streamliner's failure to clock times on the Salt last fall. Its polar moment of inertia is, of course, extremely low and it spun four times during attempted push starts... a harrowing experience for the driver.

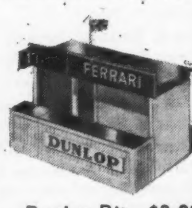
Schapel now is readying his micro-streamliner for Bonneville in 1960, is installing a 28 bhp, 250 cc Yamaha two-stroke engine and a five-speed gearbox from the same high-quality Japanese motorcycle. Also, he has gone into production with the fiberglass body which can be adapted to any kart or for which a chassis can be built inexpensively from scratch. These bodies may be obtained for \$300, FOB Los Angeles, from Rod Schapel, 11661 Jewel Lane, Garden Grove, Calif. and if five such cars should appear at Bonneville a new competition class would be recognized automatically.

—GB

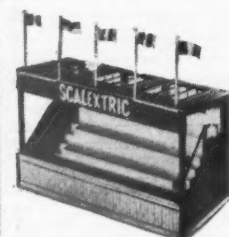
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contoured glove compartment, and

a jump-seat that obligingly lifts out

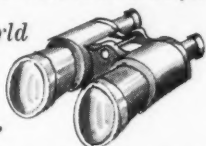
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